CYBER SWITCHING®

ePower

Power Distribution Unit
User Manual

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Document Part Number: 1013172

Revision 1.1

November, 2010

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Radio Frequency Interference

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device will accept any interference received, including interference that may cause undesired operation.

This Class "A" digital apparatus meets all requirements of the Canadian Interface Causing Equipment Regulations. (Cet appareil numérique de la classe "A" respecte toutes les exigencies du réglement sur le materiel brouilleur du Canada.)

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Contents

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1   Hardware Overview

Key Features

The ePower™ power distribution unit (PDU) provides a complete data center and building infrastructure power management solution.

A full-color LCD touch screen allows onsite personnel to view and manage crucial status information including load details, input line use, and system status. Detailed, real-time power information is always available to information technology (IT) and facilities managers. Lastly, using the touch screen, the entire unit can be locally configured, without the use of a computer.

The ePower PDU provides power information specific to each individual outlet, billing-grade metering, and information for load balancing and build-outs. The ePower load shedding features reduce total energy usage, while still protecting mission-critical applications.

- Color LCD touch screen

  - Interactive screen allows for local management

  - Network access configuration can be completed within five minutes, without a computer connection

- Cyber Breaker® the Virtual Circuit Breaker™

  - "Trips" an individual outlet when the amperage exceeds a user-defined threshold trip curve

  - Limits overcurrent conditions to a single outlet, protecting equipment

  - Faster circuit breaker response times

- Individual outlet metering and control

  - Billing-grade metering (±2% accuracy)

  - Usage tracking

- Two high-speed USB ports, with support of up to 127 simultaneous peripherals, such as environmental sensors, webcams, and hubs

- UL 489A listed circuit breakers (model-dependent)

Hardware Configuration

The specific configuration of AC receptacles and bank circuit breakers is dependent on the ePower model purchased. The main ePower components and interfaces are shown in Figure 1-1, Figure 1-2, and Figure 1-3.

Figure 1-1   Communication Ports, LCD Touch Screen, and Reset Button Access
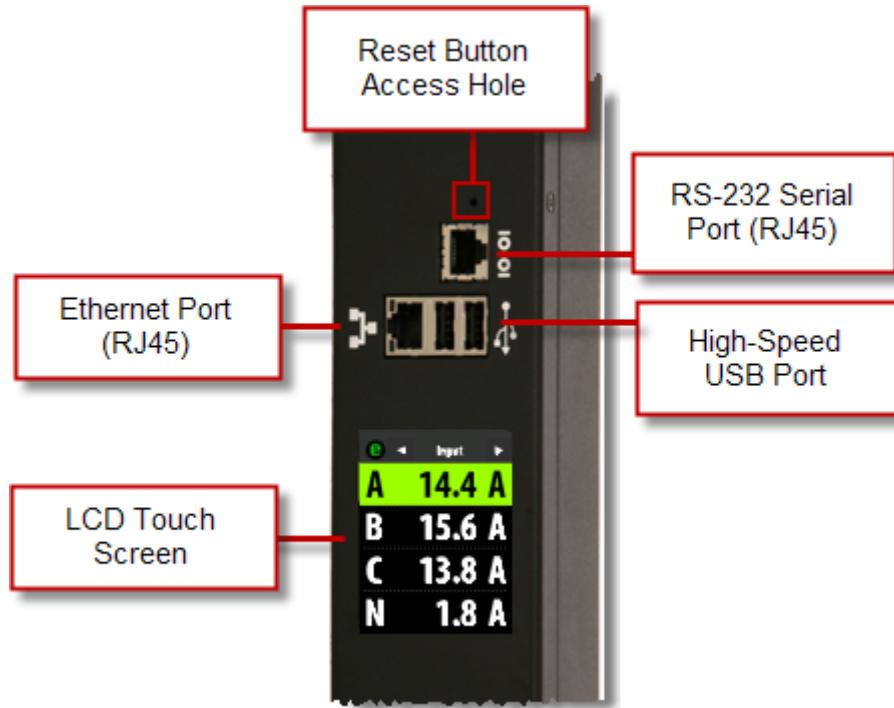
Figure 1-2   Sample AC Receptacles
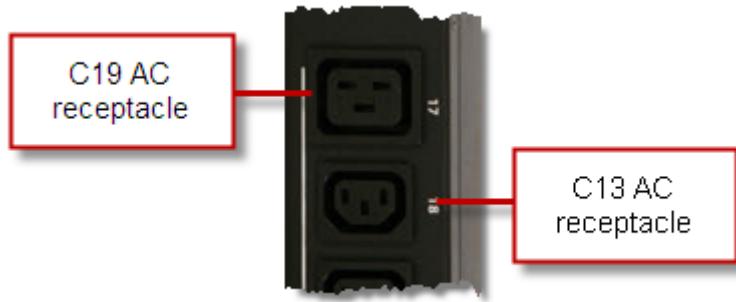
Figure 1-3   Sample Circuit Breaker and Input Power Cord
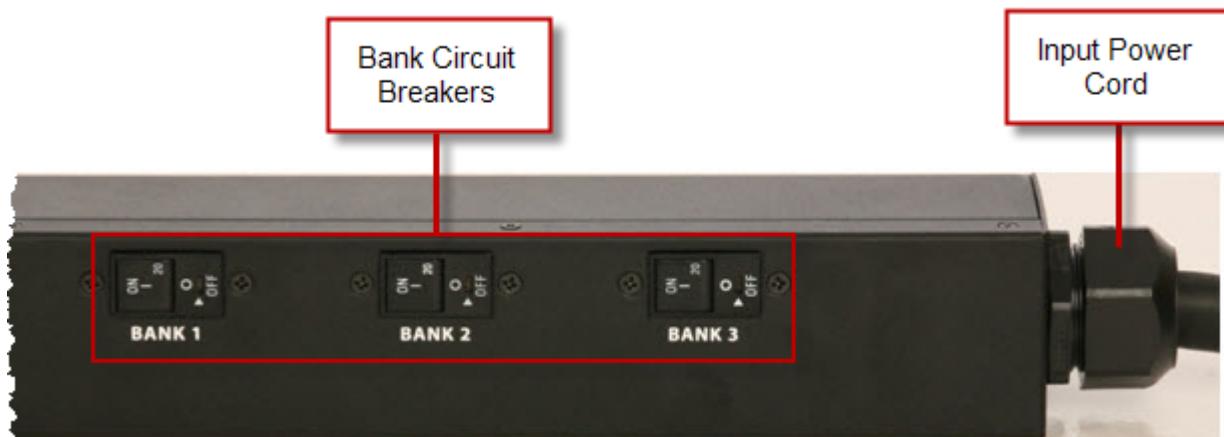
Specifications

This section lists the following specifications:

- Ratings
- Operating Environment
- Dimensions
- Compatible Browsers
- RS-232 Serial Port Specifications

Ratings

The nameplate displays the model number and specific input and output power ratings for the ePower unit, as shown in Figure 1-4.

Figure 1-4   Sample ePower Nameplate
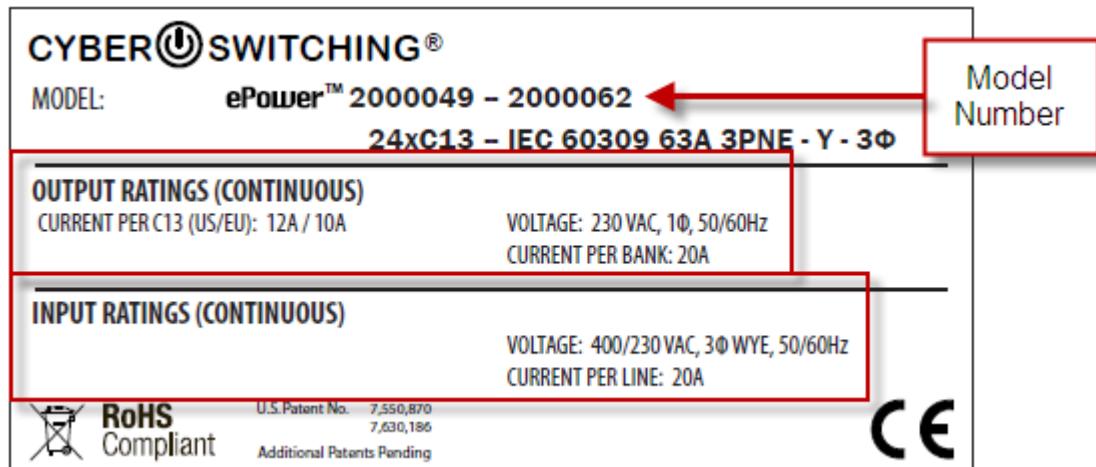
Operating Environment

Table 1-1   Operating Environment

Condition	Specification
Ambient Temperature	0 to 45°C
Relative Humidity	≤ 85%

Dimensions

ePower dimensions exclude mounting hardware, input cord connection, and cord bend radius. Dimensions vary depending on the specific model options, as listed in Table 1-2.

Table 1-2   Dimensions

Model Options	Dimensions (inches)
1φ or 3φ without circuit breakers	56.00 H x 2.40 W x 2.40 D
1φ with two circuit breakers	59.00 H x 2.40 W x 2.75 D[a]
1φ with four circuit breakers	62.00 H x 2.40 W x 2.75 D[a]
3φ with three circuit breakers	65.00 H x 2.40 W x 2.75 D[a]

a. Allow an additional 0.25-inch clearance for tripped circuit breakers.

Compatible Browsers

The following Web browsers have been tested, and deemed compatible with, the ePower Web interface:

- Microsoft Internet Explorer, versions 7 and 8
- Mozilla Firefox, versions 3.0 to 3.6.x

RS-232 Serial Port Specifications

Table 1-3   RS-232 Settings

Setting	Value
Baud	115,200
Data Bits	8
Parity	No
Stop Bits	1
Flow Control	None

Table 1-4   RJ45 RS-232 Pinout

Pin	Name	Notes
1	RTS	Not used
2	DTR	Not used
3	TXD	
4	GND	
5	GND	
6	RXD	
7	DSR	Not used
8	CTS	Not used

Maintenance

There are no field-serviceable components inside the ePower PDU. Do not open the ePower PDU. Opening the PDU voids the warranty and can cause serious electrical shock.

Wipe LCD touch screen with a soft, non-abrasive cloth to remove fingerprints.

Do not use liquids or chemicals on the ePower casing or LCD touch screen.

2 Installing the ePower PDU

Perform these two steps to install the ePower PDU:

- Installing the ePower Hardware

- Configuring the Initial ePower Communication

Safety Instructions

For your safety, observe the following precautions when setting up the ePower PDU:

CAUTION At initial inspection, if the ePower unit appears to be damaged, do not install it. Contact Cyber Switching immediately.

CAUTION Ensure that the power source's voltage and frequency match the voltage and frequency that are listed on the Cyber Switching equipment electrical rating label.

WARNING Never place foreign objects of any kind through openings in the equipment. Conductive foreign objects produce a short circuit that can cause fire, equipment damage, and/or electrical shock.

WARNING To reduce the risk of fire or electric shock, install in a controlled environment that is relatively free of contaminants.

Installing the ePower Hardware

Prior to power up and configuration, the ePower PDU must first be rack-mounted on the network/data rack where it will be used.

Cautions

CAUTION   Refer to the Safety Instructions section, prior to rack-mounting the ePower unit.

CAUTION   When installing the ePower PDU in a network/data rack, note the following safety and precautionary guidelines:

- Use only the provided mounting hardware.

- **Elevated Operating Ambient Temperature** – If the ePower unit is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment might be greater than room ambient temperature. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature specified in the Operating Environment section in Chapter 1, "Hardware Overview."

- **Reduced Air Flow** – Equipment should be installed such that the amount of air flow required for safe equipment operation is not compromised.

- **Mechanical Loading** – Equipment should be mounted such that a hazardous condition is not incurred due to uneven mechanical loading.

- Do not insert anything other than Cyber Switching-supplied screws into the mounting holes that hold the buttonhooks, located on the back side of the ePower PDU. Inserting other objects voids the warranty and poses a shock hazard and/or shorting risk.

- Avoid installing the ePower PDU in areas where spray or liquids can enter or adhere to it.

- Use only a grounded AC power outlet.

- Use of the ePower by children is prohibited.

- Do not place any foreign objects, other than electrical prongs, into the outlets.

Mounting the ePower PDU

To mount the ePower unit:

1. Standing in front of the rack upon which the ePower unit will be installed, determine where the LCD touch screen can best be viewed and used.

NOTE   The LCD touch screen automatically orients the text so that it is readable with either of its short edges at the top.

2. The ePower unit is supplied with buttonhook mounting hardware pre-installed in two locations on the back side of the unit. If the mounting buttonhooks must be moved to different locations (such as for optimum positioning of the LCD touch screen), remove them from their current location, using a #2 Phillips screwdriver. Then, use the Cyber Switching-supplied screws to reinstall the buttonhooks to their new location.

WARNING   The thread of the supplied pan-head screws is #8-32; the shank of the screw must not exceed 3/16 inches.

Use of screws or other fasteners other than those supplied by Cyber Switching voids the ePower warranty, and poses a shock hazard and shorting risk. Please contact Cyber Switching if you need additional screws.

3. Insert the buttonhooks into the large openings of the buttonholes on the rack, then lower the ePower unit until the buttonhooks rest in the lower slots of the buttonholes.
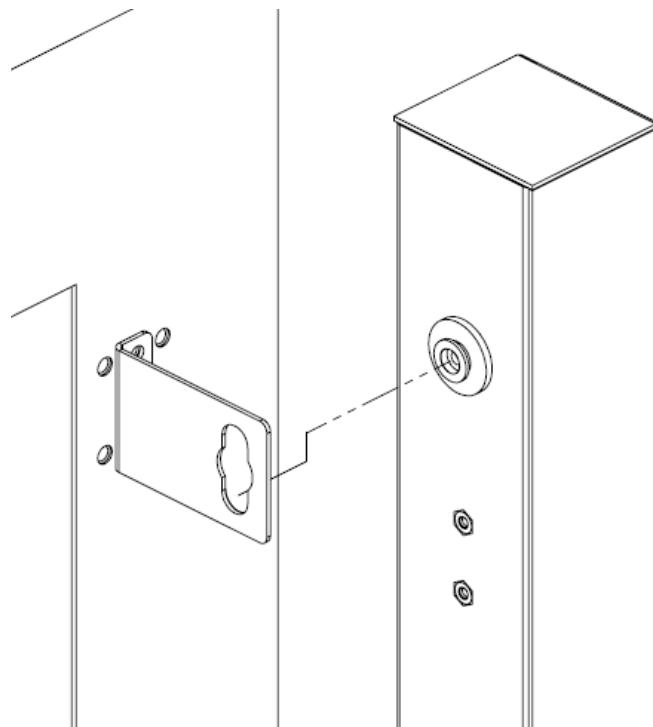
4. Determine whether the LCD touch screen can be easily viewed and used at the installed height. If not, lift and remove the buttonhooks from the rack buttonholes, then repeat steps 3 and 4, reinstalling the ePower unit at a different height on the rack.

⚠️ **CAUTION** The ePower input cord must be connected to a grounded circuit with sufficient rating for the equipment that will be connected to the ePower outlets. In addition, consideration must be given to the following issues:

- **Reliable Earthing** – Reliable earthing/grounding of rack-mounted equipment must be maintained. Particular attention must be given to supply connections other than direct connections to the branch circuit (such as the use of power strips).

- **Pluggable Equipment** – For pluggable equipment, the socket outlet should be installed near the equipment and should be easily accessible. A suitably rated, listed branch circuit breaker shall be provided as part of the building's electrical circuit support.

- **Circuit Overloading** – Consider the equipment nameplate ratings when connecting the ePower PDU to the supply circuit, and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Refer to Figure 2-1 for sample nameplate markings; the nameplate lists the ratings for the ePower unit.

Figure 2-1   Sample Nameplate Markings
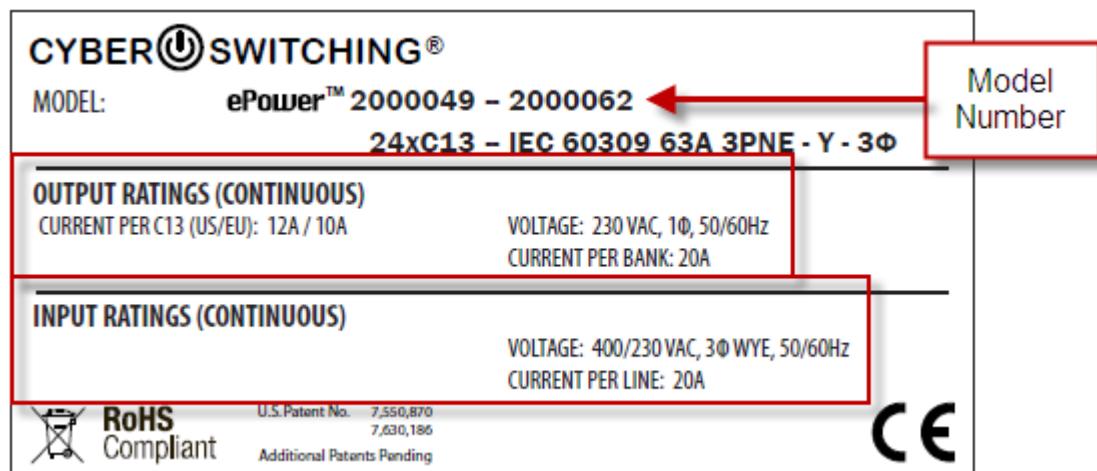
Configuring the Initial ePower Communication

When the ePower unit is first powered On, the **Booting** screen is displayed. This screen displays the following information:

- Serial Number

- MAC

- Model Number

After booting is complete (the screen will be dark for several seconds), the **Network Setup** screen is displayed. After powering up the ePower PDU, configure the ePower communication ports, as desired:

- **RS-232 serial port, using an external PC** – Refer to the Initially Configuring the RS-232 Serial Port to Use the CLI section

- **Ethernet port**, using one of the following methods:
  - **Built-in LCD touch screen** – Refer to the Configuring the Ethernet Port Using the LCD Touch Screen section
  - **Command Line Interface** – Refer to the Configuring the Ethernet Port Using the CLI section

Initially Configuring the RS-232 Serial Port to Use the CLI

To configure the serial port to use the command-line interface (CLI):

1. Attach the ePower unit to a COM port on your computer, using an RS-232D serial cable.

NOTE A USB-to-serial adapter is required if the PC does not support a serial interface. Install the USB-to-serial adapter driver before connecting the adapter to the ePower unit.

2. Set up a terminal emulation program, such as HyperTerminal, Tera Term, or minicom, using the following default settings:

   – 115,200 baud

   – 8 data bits; no parity

   – 1 stop bit

   – No flow control

3. Establish a connection and log in, using the following values:

   – User Name: **admin**

   – Password: **password**

CAUTION To prevent unauthorized access to the ePower PDU, change the password immediately after the initial configuration is complete, and periodically thereafter.

4. The ePower command prompt is displayed:

   ePower:/–>

To issue individual commands or create scripts, refer to Chapter 4, "Using the Command Line Interface," and Appendix A, "CLI Command Reference."

To configure the Ethernet port, refer to the Configuring the Ethernet Port Using the CLI section.

Configuring the Ethernet Port Using the LCD Touch Screen

To configure the ePower Ethernet port using the LCD touch screen, perform the following steps, as appropriate for your system requirements:

1. Attach the ePower unit to an Ethernet port on your computer or router, using an Ethernet cable.

2. Select **Yes** to configure the ePower network settings.
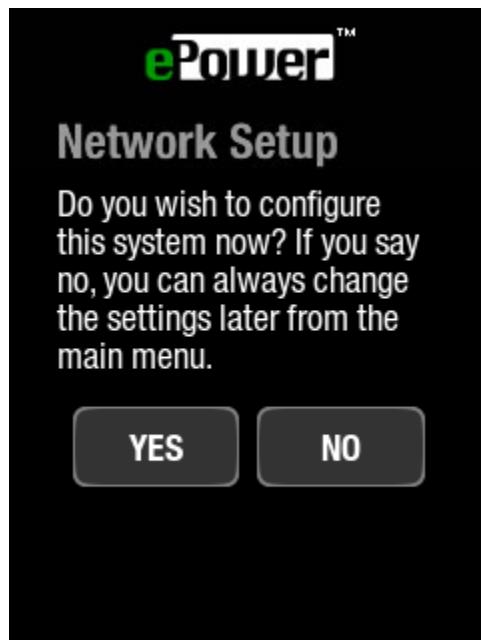
3. If you selected **No**, the **Power Info/Input Screen** is displayed.

   If you selected **Yes**, the unit asks whether you want to enable IPv4. Select **Yes** to enable IPv4

✔ **NOTE** The ePower unit can use both IPv4 and IPv6 simultaneously. Configure the IPv4 connection first, then configure the IPv6 connection.
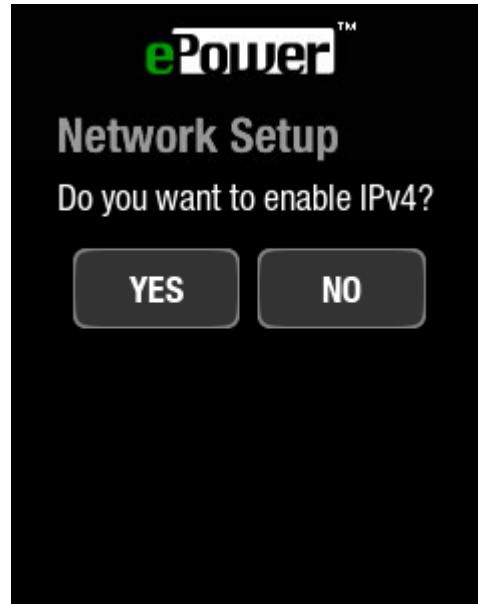
4. To enable IPv4, select the proper configuration to determine the ePower network settings – **DHCP** or **STATIC**.

5. For **DHCP**, the IPv4 configuration is complete. For a **STATIC** IPv4 address, enter the appropriate settings for the IP, netmask, and gateway addresses. IPv4 addresses are entered as three-digit dot-separated decimal addresses (for example, 128.68.82.1). Leading zeros between each period can be omitted.
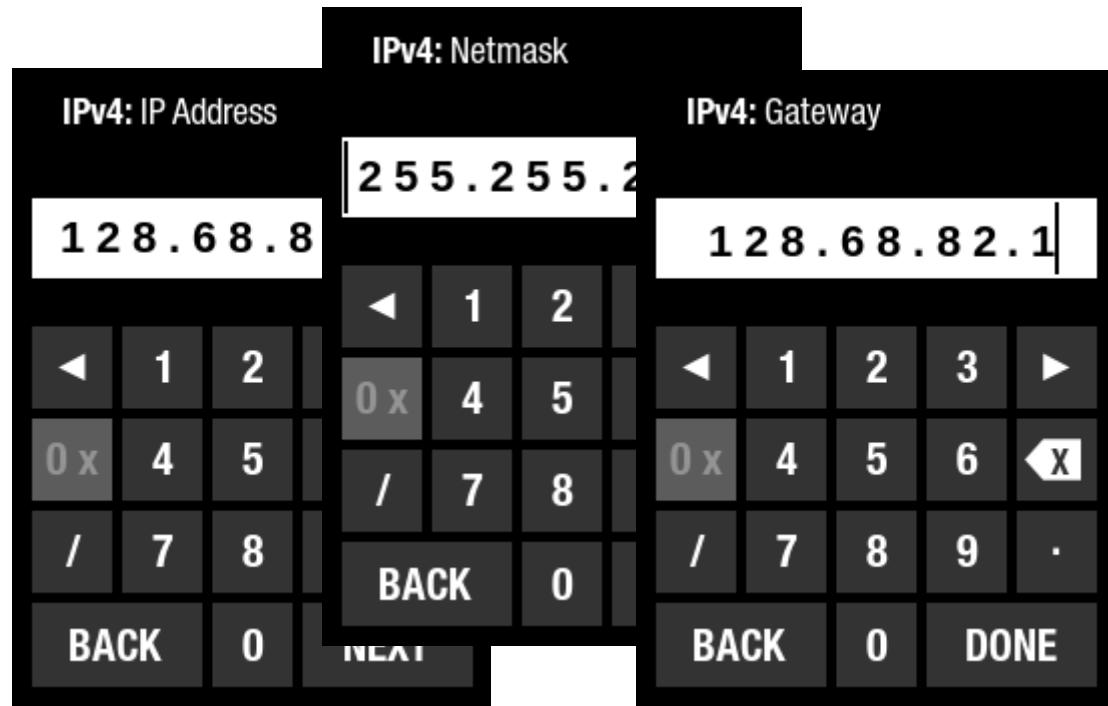
6. Next, enable IPv6, if desired. To enable IPv6, enter the appropriate settings for the IP, netmask, and gateway addresses. IPv6 addresses are entered as colon-separated four-digit hex code groups (for example, 1293:f34:13df::7). Leading zeros between the colons can be omitted. Press the "**0x/#**" key to change the keypad from numbers to hex letters and vice versa.
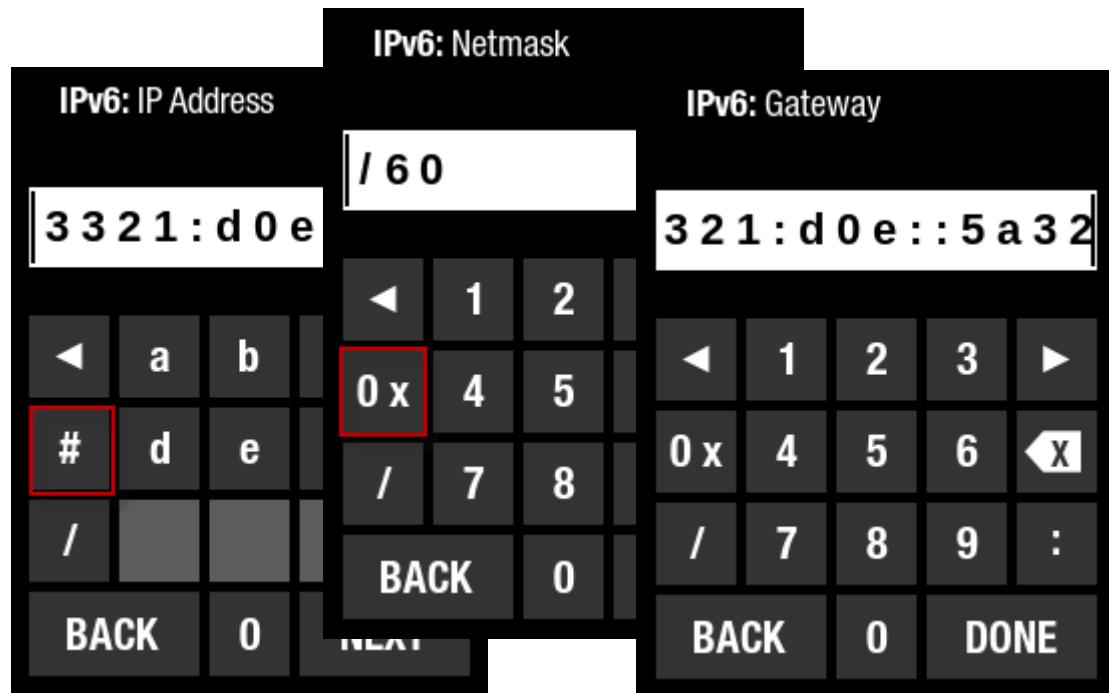
7. At this point, the communications configuration is complete and the **Power Info/Input Screen** opens.
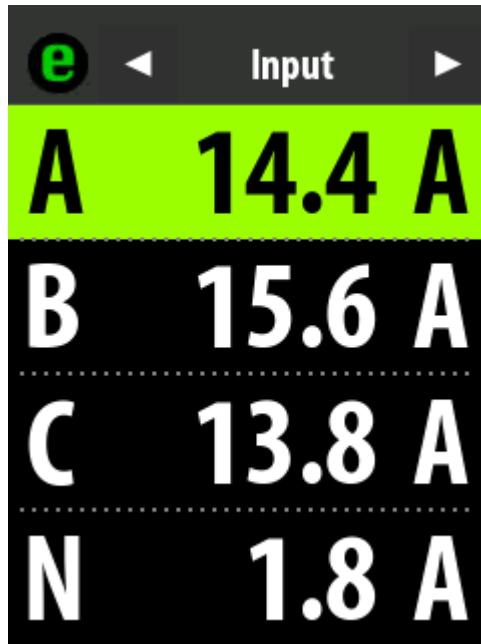
✔ **NOTE** The green bar slowly scrolls through and highlights the input list, showing that the ePower unit is powered On and operating correctly.

For additional information regarding how to use the LCD touch screen, refer to Chapter 5, "Using the LCD Touch Screen."

Configuring the Ethernet Port Using the CLI

Before you can use the CLI, you must configure the serial interface to use the CLI, as described in the Initially Configuring the RS-232 Serial Port to Use the CLI section.

NOTE   All CLI commands are entered at the ePower:/ prompt. The text within the prompt varies, depending on the directory level at the time of entry.

You can use the RS-232 serial port command-line interface (CLI) to enable either or both the IPv4 and IPv6 Ethernet protocols:

1. To enable IPv4, perform the following steps:

    a. Go to the IPv4 target by entering the following command:

       cd /system1/settings/network/ipv4

    b. If you are using DHCP, enter the following command:

       set enable=y dhcp=y

    c. If you are entering a static IP, enter the following commands to set the ePower IP address, subnet mask, and gateway IP address:

       set enable=y
       set address=*ip_address*
       set mask=*subnet_mask* gateway=*gateway_ip*

2. To enable IPv6, perform the following steps:

    a. Go to the IPv6 target by entering the following command:

       cd /system1/settings/network/ipv6

    b. To use DHCP, enter the following command:

       set enable=y dhcp=y

    c. To enter a static IP, enter the following command to set the ePower IP address, subnet mask, and gateway IP address:

       set enable=y address=*ip_address* mask=*subnet_mask* gateway=*gateway_ip*

3. The network settings must be committed before they take effect. Enter the following command to apply the new network settings:

commit /system1/settings/network

NOTE There can be a delay of up to 60 seconds before the new settings take effect.

Your ePower unit should now be connected to the network. Use one of the following methods to configure the PDU settings:

- To use the visual interface, refer to Chapter 3, "Using the ePower Web Interface."

- To issue individual commands or create scripts, refer to Chapter 4, "Using the Command Line Interface," and Appendix A, "CLI Command Reference."

3 Using the ePower Web Interface

Connecting to the Web Interface

The ePower Web interface can be accessed with a standard Web browser, using the Ethernet interface.

To connect to an ePower unit through a Web browser:

1. Attach the ePower unit to an Ethernet port on your computer or router, using an Ethernet cable.

2. Note the ePower unit IP address or fully qualified domain name (FQDN).

NOTE You can use the LCD touch screen to verify the ePower unit's IP address.

3. In the Web browser, enter the address or FQDN of the ePower unit.

4. Log in, using **admin** and **password** as the User Name and Password, respectively. (After other user accounts are created, they can also be used to log in.)

CAUTION To prevent unauthorized access to the ePower PDU, periodically change the password.

5. The **Home** page, shown in Figure 3-1, opens.

Figure 3-1   ePower Web Interface Home Page

Web Page Descriptions

The ePower Web interface allows access to the following pages:

- Home Page
- Data Page
- Setup Page
- System Page

The following icons and symbols are used throughout the ePower Web interface:

Icon / Description	Function	Description
Green dot	Outlet Status Indicator	On.
Gray dot	Outlet Status Indicator	Off.
Boxed red X	Outlet Status Indicator	Off. A Virtual Circuit Breaker has tripped.
Green counterclockwise arrow	Outlet Status Indicator	Rebooting.
Yellow triangle	Outlet Status Indicator	Warning. High/low current.
Red triangle	Outlet Status Indicator	Warning. Critical state.

Icon / Description	Function	Description
Green background behind Outlet row	Outlet Status Indicator	Mouse cursor is hovering over the row. Provided to help you keep track of where you are on the page.
Green background behind Bank tab	Bank Status Indicator	On.
Gray Background behind Bank tab	Bank Status Indicator	Off. Bank circuit breaker has tripped.
– – – – – Dashed gray line	Permission Indicator	User does not have read, write, and/or execute permission for this field.
VCB VCB text	Alert Setting Status	A Virtual Circuit Breaker trip-curve equation is set for this outlet.
↑ or VCB↑ Up arrow	Alert Setting Status	High current alert is set for this outlet, with or without the Virtual Circuit Breaker being set.
↓ or VCB↓ Down arrow	Alert Setting Status	Low current alert is set for this outlet, with or without the Virtual Circuit Breaker being set.
↕ or VCB↕ Up and down arrows	Alert Setting Status	Both high and low current alerts are set for this outlet, with or without the Virtual Circuit Breaker being set.
🔔 Gray bell	Schedule Setting Status	No alerts are set for this outlet; no alarms are active.
⏰ Alarm clock	Schedule Setting Status	Outlet schedule is set for this outlet.

Home Page

The **Home** page displays information and allows access to the following controls, as shown in Figure 3-2:

- **Banks and Outlets Pane** – Displays status and allows access to bank and outlet controls. This is the **Home** page for the ePower Web interface.

- **Input Loading Pane** – Displays current and current loads, and allows outlets to be turned Off and On.

- **Recent Logs Pane** – Displays the most-recent events in the log file.

- **Data Page** – Displays all event logs for the ePower unit.

- **Setup Page** – Allows the ePower's configuration to be updated.

- **System Page** – Displays the system's basic information (model number, and serial number, and so forth), and allows the ePower to be upgraded

- Help menu item – Directs you to Cyber Switching's ePower Technical Support Web page, www.cyberswitching.com/epower/support, where you have the option of opening a PDF of this user manual, or performing other support-related tasks.

- **Logout** menu item – Exits the ePower Web interface.

Figure 3-2   ePower Web Interface Home Page
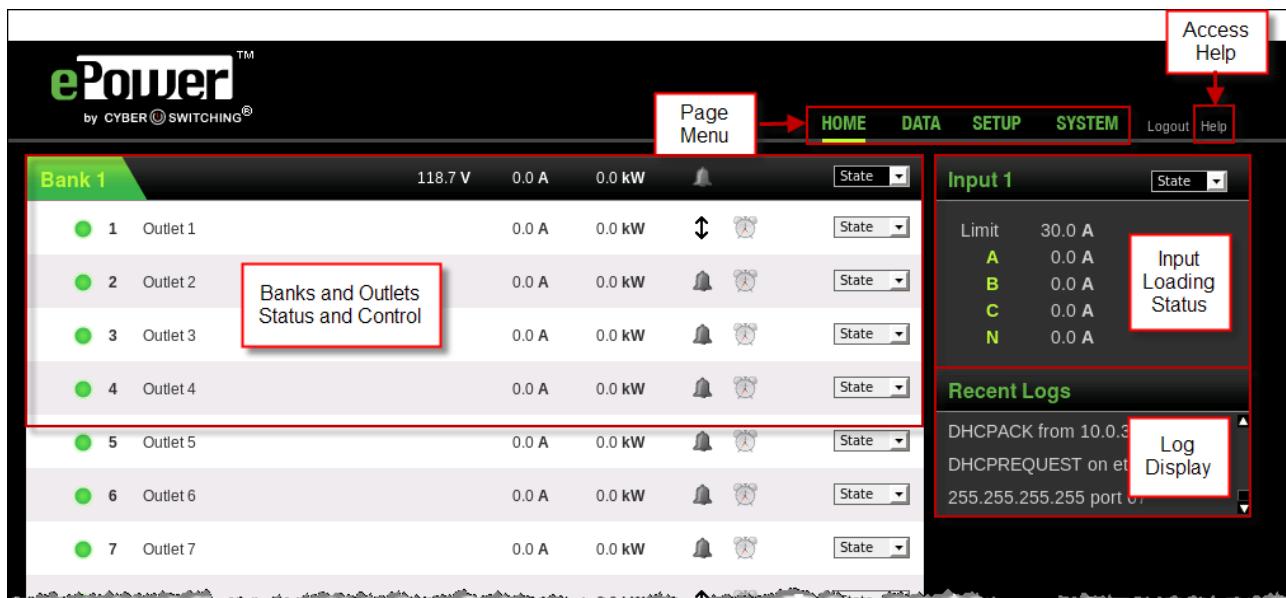
Banks and Outlets Pane

This is the **Home** page for the ePower Web interface. Displays status and allows access to the following bank and outlet controls:

- Select a bank name to access the **Bank Controls** pane for that bank.

- Select an outlet name to access the **Outlet Controls** pane for that outlet.

- Use the **State** drop-down menu to turn outlets On, Off, or begin Reboot.

The **Bank Controls** pane (refer to) includes the **Alerts** tab:

- **Enabled** – Select to enable the High Current Alert for that bank.

- **High Current Alert** – Enter **Threshold** and **Maximum Grace Period**.

- **Email Notification List** – Enter a comma-separated list of email address to notify you if the high current limit is reached. Email alerts are also entered in the **Setup Logging** pane. The following are sample email alerts:

  - Input Critical Alert Example

    Load on Input 1 Line A (32.5 A) exceeds 100% safety limit (32.0 A)

  - Input Warning Alert Example

    Load on Input 1 Line B (41.2 A) exceeds 80% safety limit (40.0 A)

  - Input User-Defined High Current Alert Example

    Load on Input 1 Line C (22.8 A) exceeds user-defined high current limit (20.5 A)

  - Bank Critical Alert Example

    Load on Bank 1 (21.5 A) exceeds 100% safety limit (20.0 A)

  - Bank Warning Alert Example

    Load on Bank 2 (17.2 A) exceeds 80% safety limit (16.0 A)

  - Bank User-Defined High Current Alert Example

    Load on Bank 3 (6.8 A) exceeds user-defined high current limit (4.0A)

Figure 3-3   Bank Controls Pane

The **Outlet Controls** pane includes three tabs – **General**, **Alerts**, and **Schedule**:

- **General** – Refer to Figure 3-4.

    – **Outlet Name** – Enter an outlet name. The outlet name is used on the **Home** and **Web Services** pages.

    – **Keywords** – A comma-separated list of keywords that can be used for filtering queries sent by way of Cisco EnergyWise.

    – **Importance** – A ranking (on a scale of 1 to 100) that compares the relative importance of this outlet versus others in the Cisco EnergyWise domain. This ranking is typically used as a filter for policy-based network management. By convention, a lower value (1) is less important than a higher value (100).

    – **Reboot Delay** – During a Reboot, the outlet is sequenced Off, then On. The Reboot delay is the time (in seconds) between turning an outlet Off, then On. Decimal values (for example, 5.375) are accepted.

    – **Overall Outlet Status** – Displays **Current** (A), **Voltage** (V), **Frequency** (Hz), **Apparent Power** (VA), **Real Power** (W), and **Power Factor** for the outlet.

Figure 3-4   Outlet Controls Pane – General Tab

- **Alerts**

  – **Enabled check boxes** – Select to allow access to items on the **Outlet Alerts** tab.

  – **Virtual Circuit Breaker** – Enter the **Threshold**, **Maximum Grace Period**, **Minimum Grace Period**, and **Curve Constant**; refer to Chapter 6, "Configuring Cyber Breaker the Virtual Circuit Breaker."

  – **High Current Alert** – Enter the **Threshold** and **Maximum Grace Period**, then select **Save**.

  – **Low Current Alert** – Enter the **Threshold** and **Maximum Grace Period**, then select **Save**.

  – **Email Notification List** – Enter a comma-separated list of email address to notify if limits are reached. Email alerts are also entered in the **Setup Logging** pane.

    - Outlet Critical Alert Example

      Load on Outlet 1 (18.3 A) exceeds 100% safety limit (15.0 A)

    - Outlet Warning Alert Example

      Load on Outlet 1 (14.8 A) exceeds 80% safety limit (12.0 A)

    - Outlet Safety Virtual Circuit Breaker Alert Example

      Load on Outlet 1 tripped Virtual Circuit Breaker safety limit

    - Outlet User-Defined Virtual Circuit Breaker Alert Example

      Load on Outlet 1 (17.3 A) tripped Virtual Circuit Breaker limit (15.7A)

    - Outlet User-Defined High Current Alert Example

      Load on Outlet 1 (9.6 A) exceeds user-defined high current limit (8.0 A)

    - Outlet User-Defined Low Current Alert Example

      Load on Outlet 1 (1.2 A) exceeds user-defined low current limit (3.0 A)

- **Schedule** – Select **Basic** or **Advanced** from the drop-down menu.
    - **Basic** – Refer to Figure 3-5.
        - **To enter an event** – Select event type and time, then select **Add Event**.
        - **To delete a scheduled event** – Select item from scroll list, then select **Remove Event**.

✔ **NOTE** Use the **Setup** > **Date & Time Tab** to ensure that the ePower clock is set to the correct timezone.

Figure 3-5   Outlet Control Pane – Schedule Tab
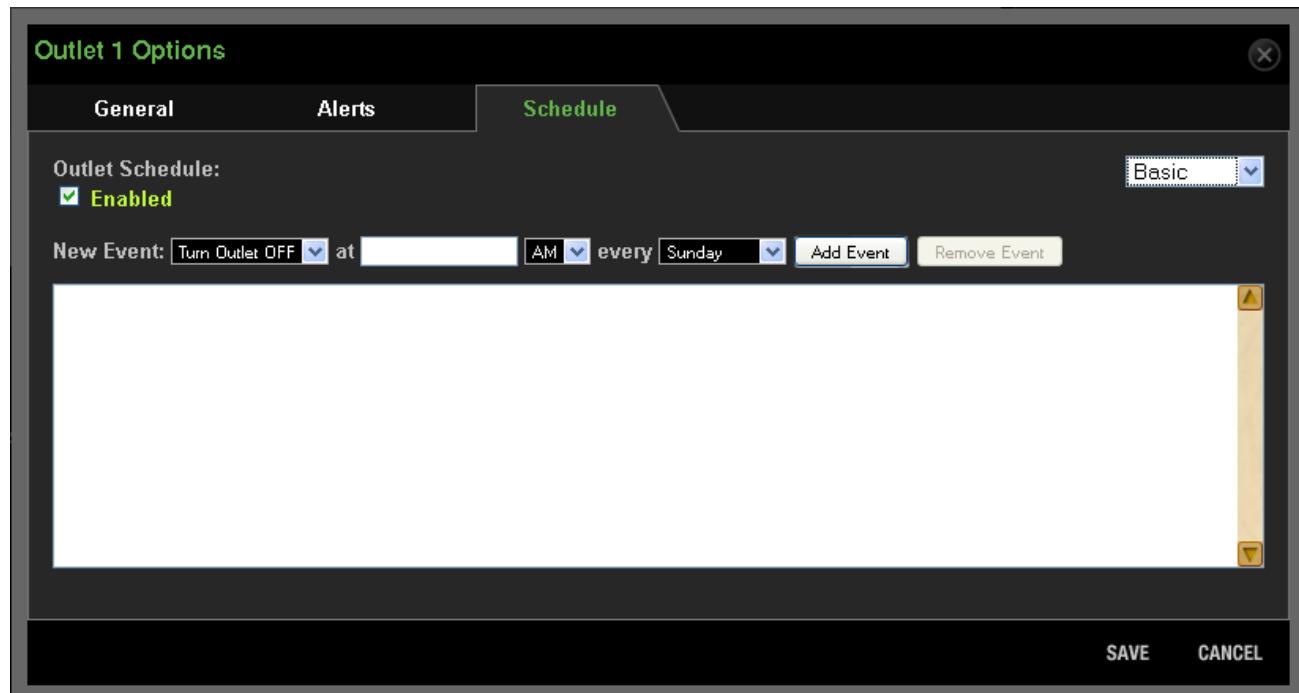
– **Advanced** – Enter crontab commands in the text box.
The supported commands are:

- On

- Off

- Reboot

✔ **NOTE**   crontab is a configuration file that specifies outlet state change events to perform on a specific schedule.

To enter crontab commands:

1. Select **Advanced** from the drop-down menu.

2. Enter commands in the text box (refer to Figure 3-6).

3. Select **OK**.

Figure 3-6   Outlet Control Pane – Scheduling Tab - Advanced
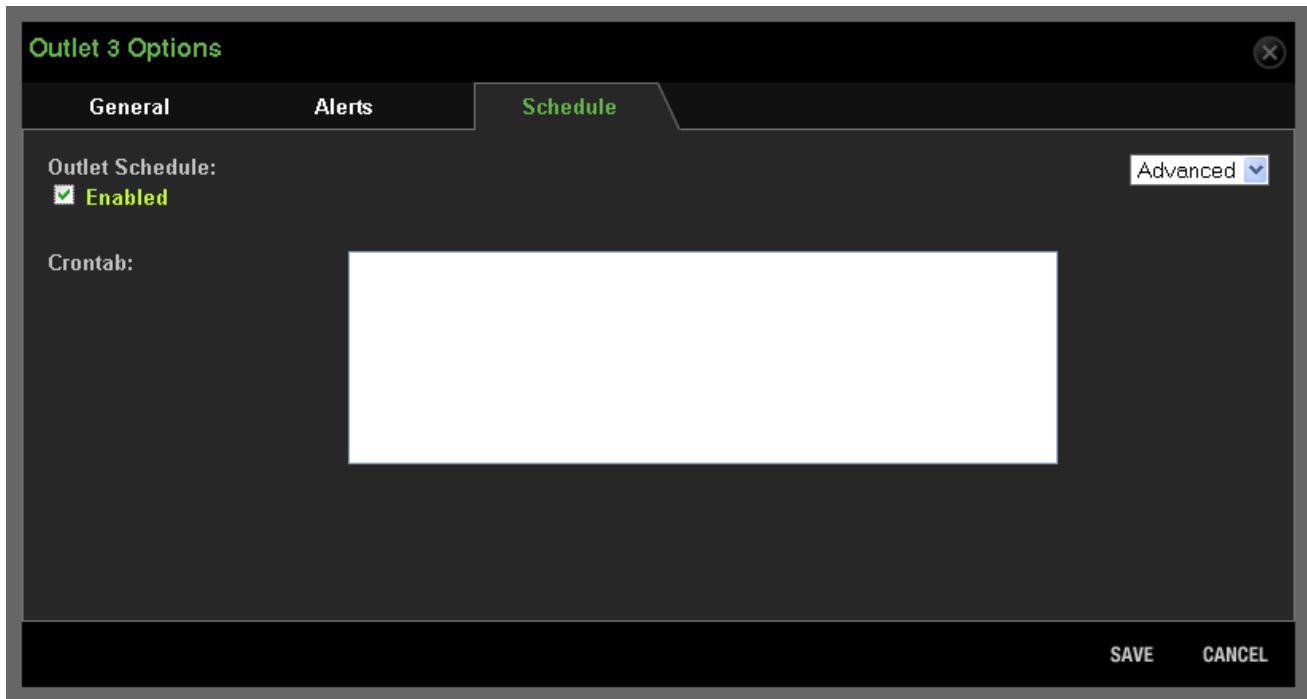
Input Loading Pane

The **Input Loading** pane displays I_{max} (**Limit** column) for each input line and the current load for each input line. The pane also allows all child outlets of that input to be turned On, Off, or Rebooted using the **State** drop-down menu.
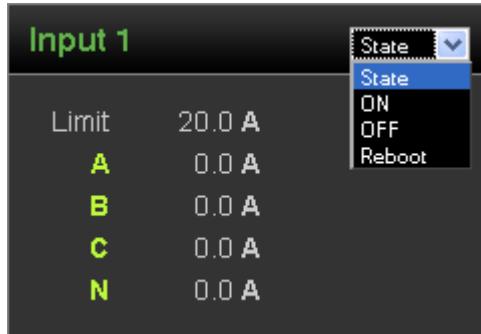
Recent Logs Pane

The complete event log can be accessed using the Data Page.
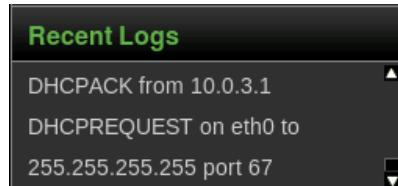
Logout

To prevent unauthorized access to the ePower Web interface, close the Web browser window after logging off.

NOTE   The ePower Web interface uses HTTP Basic Authentication. **Logout** attempts to clear this authentication, but this is not guaranteed, because it is Web browser-dependent. The best way to ensure a secure logout is to close the Web browser, including all tabs and windows.

Data Page

On the **Data** page, you can view the log of events associated with the ePower unit:

- Select the **Status** or **Date Logged** column title to sort the list according to that column's contents

- Use the **Priority** drop-down menu to select which events to display

- A summary of each outlet's current and power draw is displayed on the right side of the page

Figure 3-7   ePower Data Page

Setup Page

Through the **Setup** page, you can edit various settings using these tabs:

- Date & Time Tab

- Users Tab

- Network Tab

- Proxy Tab

- Logging Tab

- Interfaces Tab

- General Tab

Date & Time Tab

Use the **Date & Time** tab to specify:

- Whether to use Network Time Protocol (NTP) to set the date and time or to set those items manually

- NTP servers to query for network time information

- Local timezone

Users Tab

Use the **Users** tab to:

- Create, edit, and or delete ePower user accounts

- Specify whether a user account is an administrator account

- Set specific permissions for a user account

  - Read

    User is allowed to read properties on the outlet, bank, or input.

  - Write

    User is allowed to change settings on the outlet, bank, or input, such as the name or alert configurations.

  - Execute

    User is allowed to change the state on the outlet, bank, or input, such as On, Off, or Reboot.

Figure 3-8   ePower Setup Page, Users Tab

Network Tab

Use the **Network** tab to configure the following system parameters:

- Hostname
- Domain name
- DNS servers
- IPv4 settings
- IPv6 settings

Proxy Tab

Use the **Proxy** tab to:

- Define a proxy server (if necessary) for the ePower unit to use for TCP socket communication
- Specify HTTP and SSL proxies

Logging Tab

Use the **Logging** tab to:

- Set the Syslog server details and priority level threshold for forwarding system events
- Set the SMTP email server details for sending alert notifications

Interfaces Tab

Use the **Interfaces** tab to enable which interfaces to use when accessing the ePower unit remotely. Select from the following:

- HTTP

  Redirect to HTTPS for increased security

- Telnet

- SSH

- Enable Cisco® EnergyWise

  Refer to Appendix C, "Cisco EnergyWise," for details.

Figure 3-9   ePower Setup Page, Interfaces Tab, Cisco EnergyWise Section

General Tab

Use the **General** tab to:

- Specify the System Contact and System Location
- Set the Stagger-On Delay setting

  Use to minimize current spikes during the power-on cycle. Sets the delay before power-on of the next outlet after one outlet turns On. Delay is in seconds per outlet.

System Page

Use the **System** page to:

- Display the System Info Tab
- Access the Maintenance Tab

System Info Tab

The **System Info** tab displays basic information about the ePower unit, including:

- Model Number
- Model Description
- Serial Number
- Manufacture Date

Maintenance Tab

The **Maintenance** tab provides access to Firmware Upgrades.

Firmware Upgrades

Cyber Switching maintains a public mailing list to announce new firmware releases. Visit www.cyberswitching.com to register to receive these announcements.

To update the firmware:

1. Select **Upgrade**.

2. The ePower unit attempts to communicate to the Cyber Switching centralized servers at epower.cyberswitching.com.

3. The ePower unit downloads all available updates, checks the transaction to ensure it can be applied successfully, then executes the transaction.

4. If the upgrade is successful, the ePower unit automatically Reboots. (Outlet states are not affected during the upgrade.)

5. If the upgrade has an error, the upgrade is canceled.

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4   Using the Command Line Interface

After the RS-232D serial cable is connected and the RS-232 serial port is configured (refer to the Initially Configuring the RS-232 Serial Port to Use the CLI section in Chapter 2, "Installing the ePower PDU"), the CLI for ePower is ready for use. Enter CLI commands at the ePower command prompt, using the command syntax as described within this chapter. You can also create script files containing multiple ePower commands, and issue them by way of the serial interface.

The syntax used within the ePower CLI is as follows:

verb [*options*] [*target*] [*properties*]

Example 1:   Displays all properties in a recursive search of /system1/settings, where the address property of the target being evaluated matches 10.0.3.120.

ePower:/––> show -d properties -l all /system1/settings address==10.0.3.120

/system1/settings/network/ipv4

Properties:

      address = 10.0.3.120

      dhcp = Y

      enable = Y

      gateway = 10.0.3.1

      mask = 255.255.255.0

Where:

- **verb** – show

  The verb describes the action that is to be performed on a specified target or property.

- **options** – "-d properties" and "-l all"

  Options are flags that change the way that the verb acts.

- **target** – /system1/settings

  The target specifies the managed element on which that verb operates.

- **properties** – address==10.0.3.120

  Properties specify terms to use as filters.

The supported ePower verbs are:

- cd – Changes the current default target
- commit – Sets and/or updates a section of properties within a managed element
- exit – Terminates the ePower CLI process
- help – Displays information regarding how to use the ePower CLI
- reset – Restarts the ePower unit, from boot-up
- set – Sets the value of properties within a managed element
- show – Displays the contents of a target
- version – Displays current version information for the ePower firmware

Refer to Appendix A, "CLI Command Reference," for a detailed syntax description.

5 Using the LCD Touch Screen

Basic Navigation

The eMenu button is located in the upper left corner of the LCD touch screen (refer to the Screen Descriptions section). The current screen's title is centered between two arrows. The left arrow navigates to the previous screen. The right arrow navigates to the next screen.
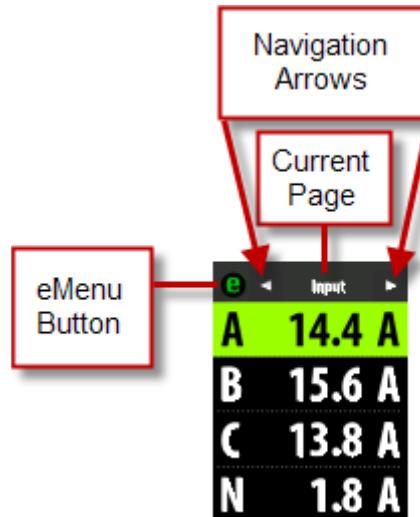
✔ NOTE   The green highlight bar slowly scrolls through and highlights the input list, confirming that the ePower unit is powered On and operating correctly.

✔ NOTE   The overall LCD touch screen navigation maps are provided in Appendix B, "LCD Network Configuration Screens."

Screen Descriptions

Touching the eMenu button displays a drop-down menu that provides access to the following screens:

- Power Info Screen
- System Logs
- Settings Screen
- Set as Home Screen
- Alerts Screen
- Lock Screen

Power Info Screen

Use the **Power Info** screen to view the power information for the input or any of the banks:

- The **Input** screens display the real-time status of each input.

- The **Bank** screens display the real-time status of each outlet. Selecting a particular outlet provides additional details regarding that outlet, as well as the ability to turn On, turn Off, or Reboot the selected outlet.

Example 1: Reboot an outlet.

This example shows the status of Outlet 1 in Bank 1, a Dell Power Edge Server, which is currently Rebooting.
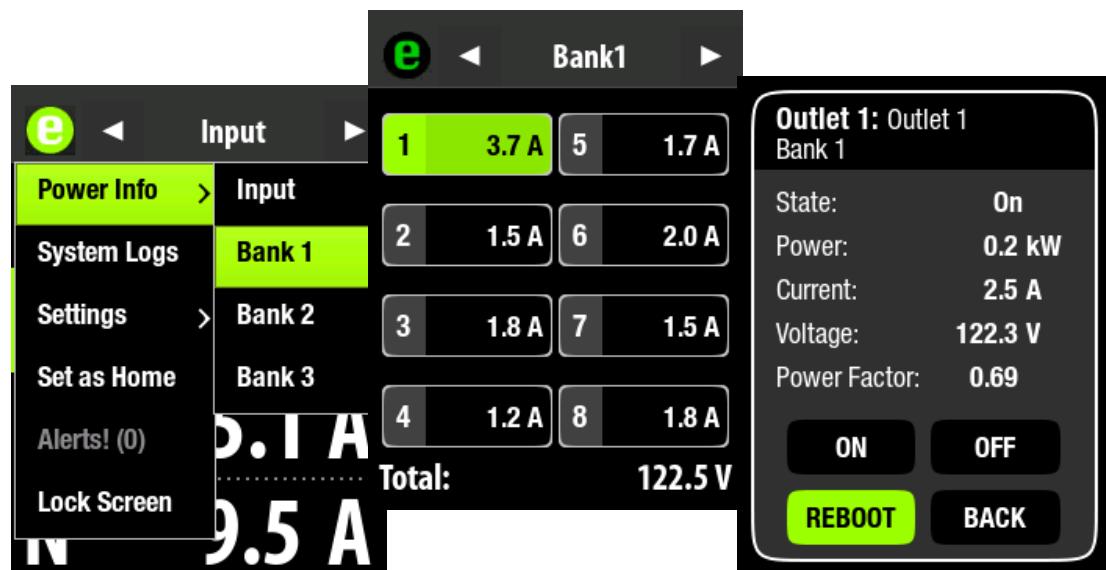
System Logs

Use the **System Logs** screen to view the log of the various system alerts that have occurred.
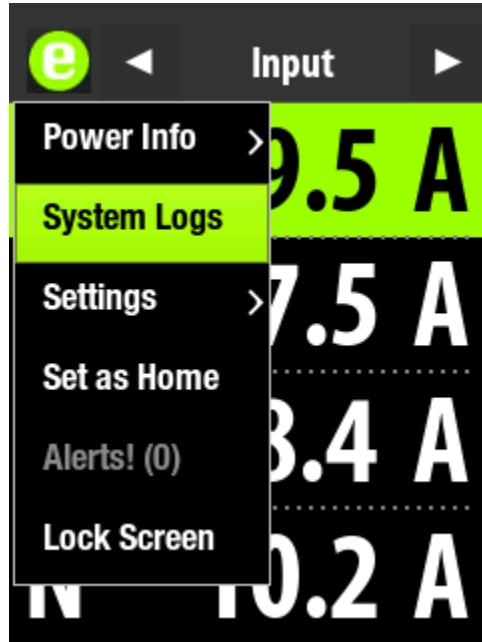
Use the up/down arrow to scroll through the specific alert (example alert shown in Figure 5-1). Use the left and right navigation arrows to view the previous or next alert, respectively.

Figure 5-1   Sample Alert (Gold Highlighting Flashes On and Off)

Settings Screen

Use the **Settings** screen to view, configure, and reconfigure the IPv4
or IPv6 network settings.

When reconfiguring the settings, a warning that you will lose the previous
settings is displayed. If you select **Yes** to continue, follow the procedure
provided in the Configuring the Ethernet Port Using the LCD Touch Screen
section in Chapter 2, "Installing the ePower PDU."
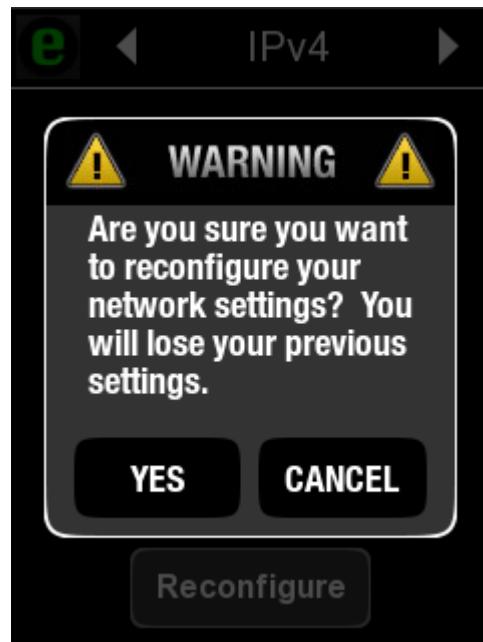
Set as Home Screen

The **Set as Home** screen sets the current screen as the home screen.

1. Select the **Set as Home** menu item. A confirmation screen opens.

2. Select **Yes** to confirm that you want the current screen to be the new home screen.
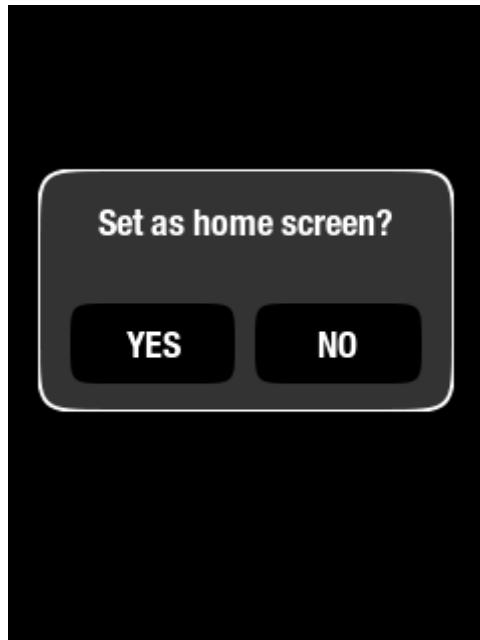
NOTE Prolonged time spent on any screen without touching the LCD touch screen results in returning to the designated home screen. By default, the home screen is set as the **Input Power** screen.

Alerts Screen

The **Alert** screen displays all the current alerts on the system (example alert shown in Figure 5-2). Only alerts that have been "dismissed" are removed from the Alerts section. Dismissed alerts can be viewed in the system logs (refer to the System Logs section).

Figure 5-2   Sample Alert (Gold Highlighting Flashes On and Off)
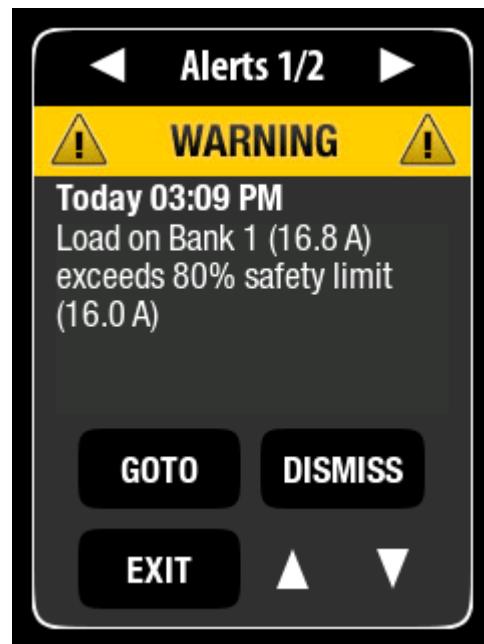
Lock Screen

To lock the ePower LCD touch screen:

1. Select the **Lock Screen** menu item.
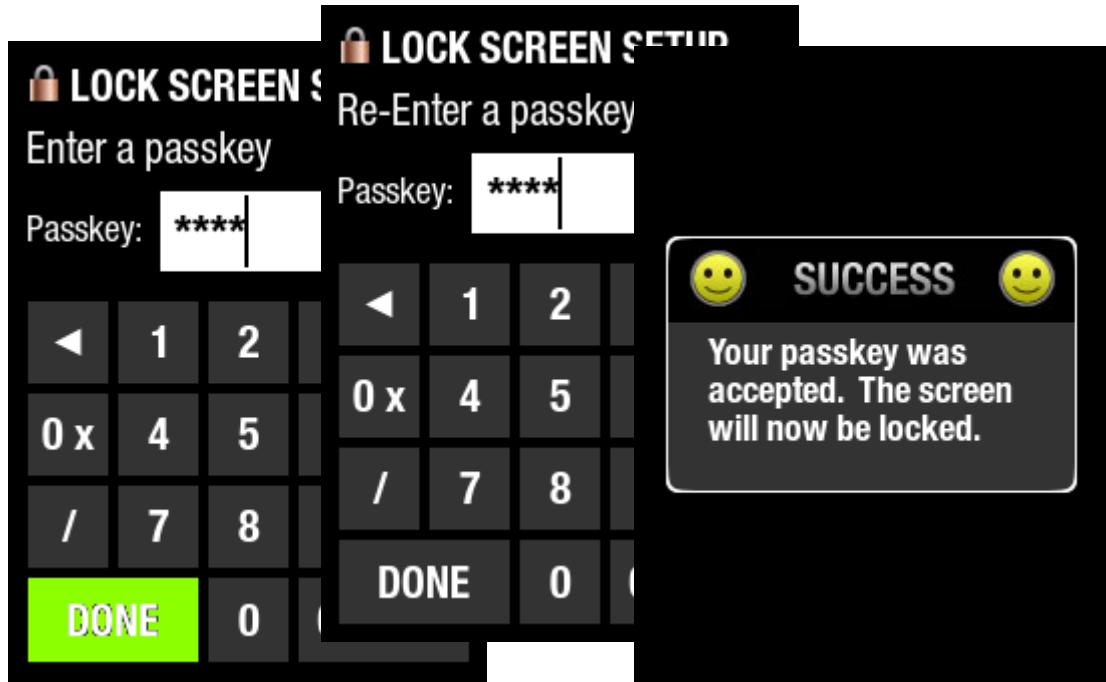
2. Enter a passkey on the LCD touch screen keypad. The passkey can be any combination of numbers and letters on the keypad. Press the "**0x**"/"**#**" key to change the keypad from numbers to hex letters and vice versa.

3. Select **Done**.

4. Enter the passkey a second time, to verify the entry.

5. Select **Done**. If the second passkey matches the first passkey, a "Success" message is displayed.

   The display returns to the home screen, and responds to all attempts to use the LCD touch screen, by displaying the **Locked Screen** page.

6. To unlock the screen, enter the correct passkey on the LCD touch screen keypad, then select **Done**.

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6 ~~Configuring Cyber Breaker~~ the Virtual Circuit Breaker

In addition to the optional hardware circuit breakers for each bank of outlets, the ePower PDU provides an adjustable Virtual Circuit Breaker for each outlet, known as a ~~Cyber Breaker®~~ the Virtual Circuit Breaker™ (referred to as "Virtual Circuit Breaker" or "VCB" within in this user manual and the Web interface). Under certain conditions, a Virtual Circuit Breaker provides faster response times than a hardware circuit breaker by way of a user-definable trip curve (refer to Example 1 and Example 2).

> ✔ **NOTE**   UL 489A (10th edition) defines an "adjustable circuit breaker" as "a circuit breaker that has adjustable time/current tripping characteristics. These characteristics may include (a) inverse-time (such as continuous current, long time, and/or short time); (b) instantaneous; and/or (c) ground-fault."

Theory

Each Virtual Circuit Breaker operates according to a trip-curve equation that relates actual current to trip delay time, resulting in the following features:

- Limits over-current conditions to a single outlet

- Turns Off an outlet when the amperage exceeds a user-defined threshold

- Decreases trip delay time as current increases

A Virtual Circuit Breaker behaves according to the following algorithm:

- From 0A to the user-defined current threshold (I_{min}), a Virtual Circuit Breaker does not trip

- At the rated current load (I_{min}), the trip delay equals t_{grace}

- Trip delay decreases per the user-defined curve as current increases

- At 34A (I_{max}), the trip delay equals t_{min}

- Above I_{max}, a Virtual Circuit Breaker trips instantaneously

✔ **NOTE**   UL 489A (10th edition) defines an "instantaneous trip" as "a qualifying term indicating that no delay is purposely introduced in the automatic tripping of the circuit breaker."

Trip Delay Curve Equation

The trip delay curve equation for t_{delay} (represented by the function $f(x)$) for any given current (x) above I_{min} is:

where variables a, b, c, and d are as described in Table 6-1.

$$f(\chi) = \left[a \cdot e^{-b(\chi - c)} \right] + d$$

Table 6-1   Trip Delay Curve Equation Variables

Variable	Description	Default Value
$a = t_{grace}$	Maximum t_{delay} at I_{min}	400 sec
b	Curve "slope" constant[a]	0.30
$c = I_{min}$	Minimum threshold where a Virtual Circuit Breaker is active	16A
$d = t_{min}$	Minimum t_{delay} for I_{actual} up to I_{max}[b]	-1.81 sec

a. Slope "b" is chosen through trial and error, to fit the curve to the desired values. It is recommended that you first model this in Microsoft Excel, and play with the values before setting this to a different value.

b. I_{max} is an "instantaneous" drop point. If the current exceeds this value, Virtual Circuit Breaker uses a grace period of 0 seconds, regardless of what the equation calculates for $f(x)$.

Example 1

In this example, a Virtual Circuit Breaker is configured on an IEC 60309 C19 outlet, with a maximum current rating of 20A. The trip delay starts at 7 seconds ($a=7$) at 4A ($c=4$, the breaker trip value), and decreases until it reaches 2.5 seconds ($d=2.5$) at 20A. Above 20A, the trip delay is 0 seconds.

The equation for the Example 1 trip delay curve under 20A is:

$$f(\chi) = \left[7 \cdot e^{-0.333(\chi - 4)} \right] + 2.5$$

Figure 6-1   Example 1 – Virtual Circuit Breaker Trip Delay Curve

ePower Power Distribution Unit User Manual, Revision 1.1
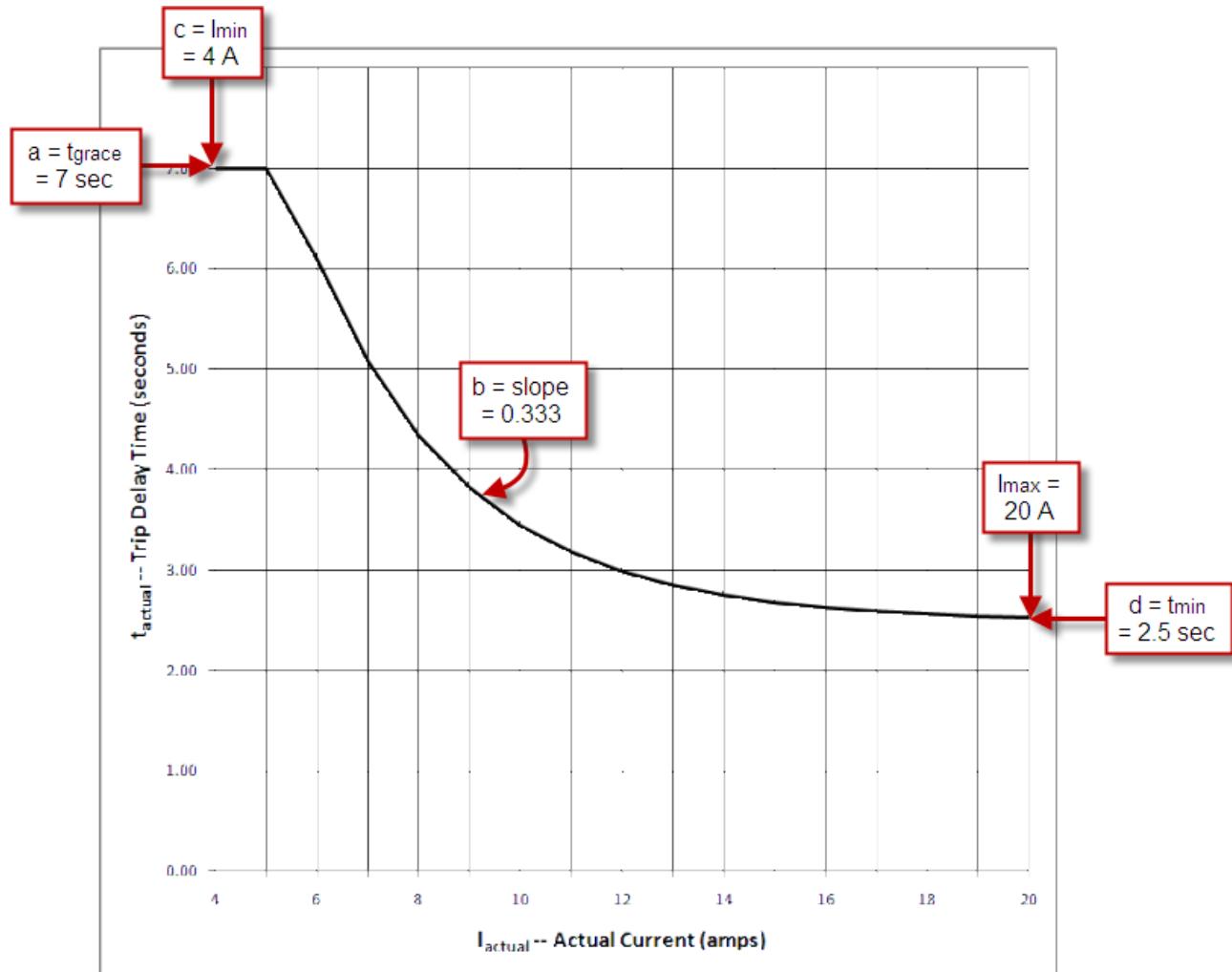
To configure a Virtual Circuit Breaker to the same settings as Example 1, set the parameters in the Web interface:

1. On the **Home** page, select the bank and outlet for which you want to set a Virtual Circuit Breaker:

2. In the **Outlet Options > Alerts** tab, select **Enabled** under **Virtual Circuit Breaker**, then enter the appropriate values for the **Threshold**, **Max. Grace Period**, **Min. Grace Period**, and **Curve Constant**, as shown:
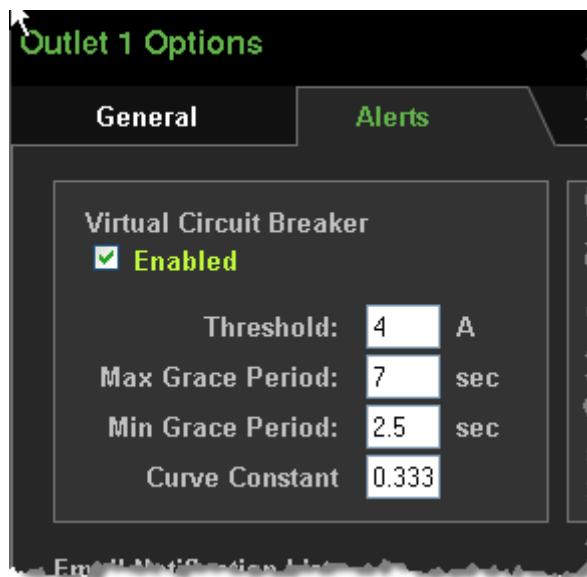
3. Select **Save**.

Example 2

In this example, a Virtual Circuit Breaker on a 20A-rated outlet starts with a trip delay of 400 seconds ($a=400$) at 16A ($c=16$, the breaker trip value). The trip delay decreases until it reaches zero seconds at 34A or greater. A negative t_{min} value ($d=-1.81$) is used to fine-tune the trip curve to a zero crossing at 34A.

The equation for the Example 2 trip delay curve is:

$$f(\chi) = \left[400 \cdot e^{-0.3(\chi - 16)}\right] - 1.81$$

Figure 6-2   Example 2 – Virtual Circuit Breaker Trip Delay Curve
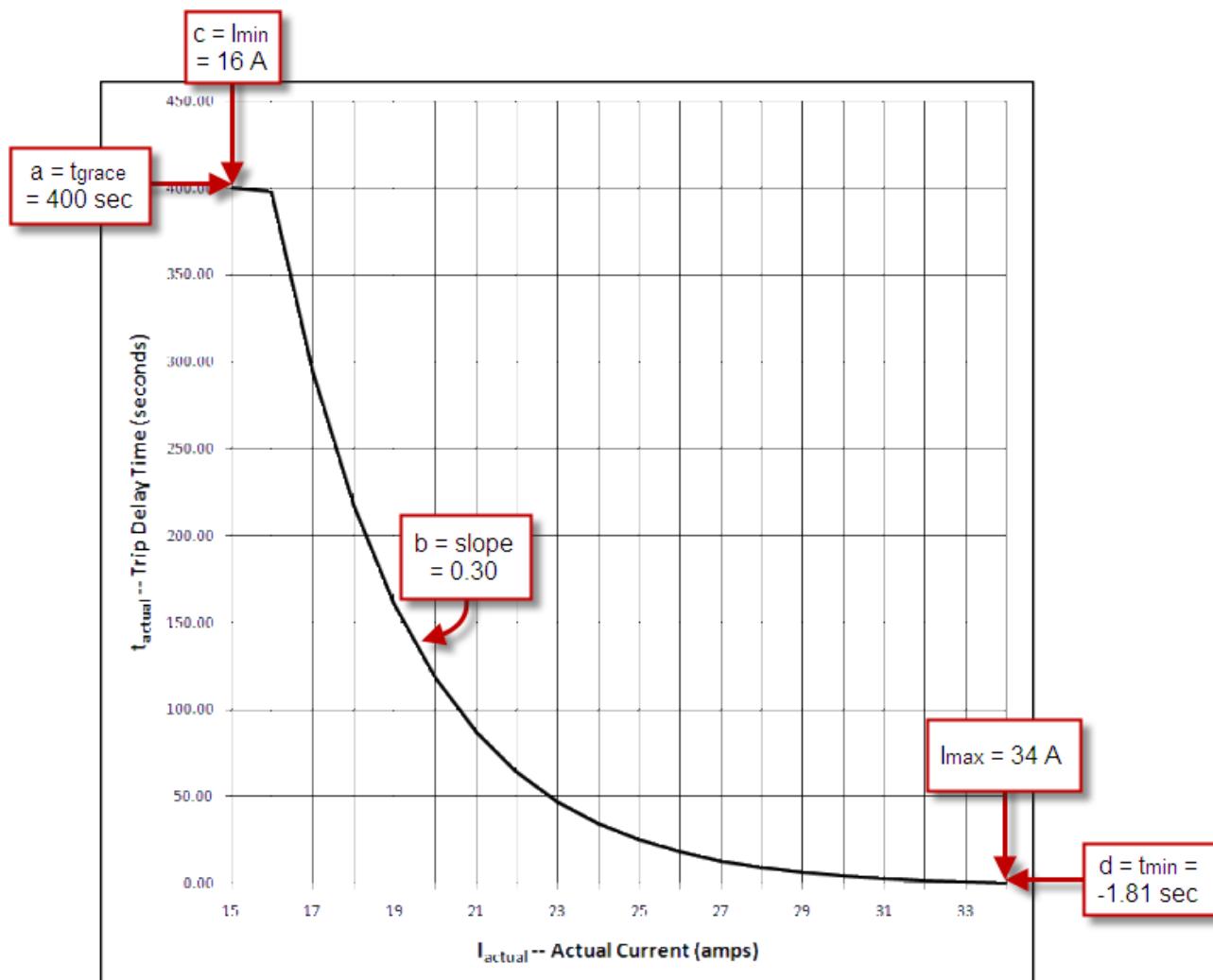
To configure a Virtual Circuit Breaker to the same settings as Example 2, set the parameters in the Web interface:

1. On the **Home** page, select the bank and outlet for which you want to set the Virtual Circuit Breaker:

2. In the **Outlet Options > Alerts** tab, select **Enabled** under **Virtual Circuit Breaker**, then enter the appropriate values for the **Threshold**, **Max. Grace Period**, **Min. Grace Period**, and **Curve Constant**, as shown:
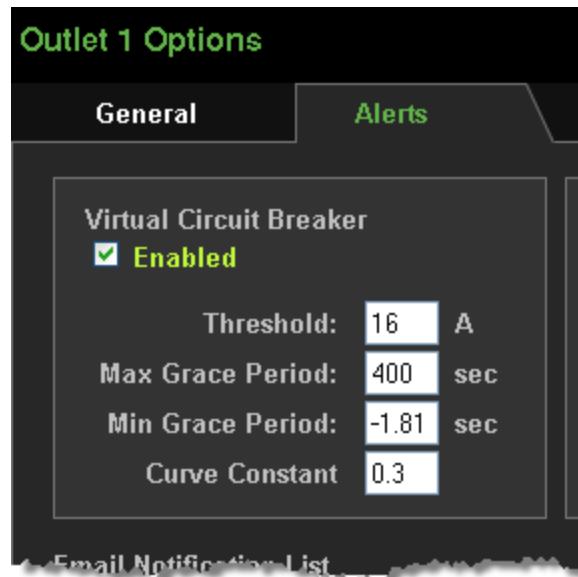
3. Select **Save**.

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7 Troubleshooting

General Questions

The following table describes how to resolve common issues that may be encountered when using the ePower unit. If the suggested solutions do not resolve the problem, contact Cyber Switching's Technical Support at support@cyberswitching.com.

For additional support information, visit www.cyberswitching.com/epower/support.

Issue	Suggested Solution
Why is there no power at the outlets?	Check to ensure that the input power cord is plugged in, that all branch circuits breakers on the unit (if any) are closed, and that the outlet is turned On.
How do I connect to the ePower using the RS-232 serial port?	Connect an RS-232D serial cable to the ePower RS-232 serial port; Set up a terminal emulation program (such as HyperTerminal, Tera Term, or minicom), and configure the program with the following settings: 115200, 8, None, 1, and no flow control.
How do I reset the ePower to factory default settings?	Refer to the Restoring Factory Default Settings section.

Issue	Suggested Solution
What is the ePower Reboot sequence?	When you Reboot an outlet, the outlet immediately turns Off, then turns back On, after the Off-to-On timer expires. The default Off-to-On delay time is five seconds. The delay time can be changed in the **Outlet Properties** dialog box, in the Web interface.
What happens if I change an outlet's state when the outlet is in the process of Rebooting?	If you turn an outlet On or Off when that outlet is still in the Reboot process, the Reboot is canceled, and the outlet immediately changes to the desired state.
What happens if I change the Off-to-On delay time when an outlet is in the process of Rebooting?	Each Reboot process uses the settings that were applied at the time the Reboot was started. Any changes made after the Reboot starts are used for subsequent Reboot requests.
An outlet is not working, and no alert was issued.	First, ensure that the equipment connected to the outlet is fully plugged in, and that the equipment is turned On. Next, try turning On the outlet from the ePower Web interface, even if the outlet reports that it is already On. If this does not resolve the problem, contact Cyber Switching's Technical Support at support@cyberswitching.com.
The message jffs2_sum_write_data: Not enough space for summary, padsize = XXXX. appeared in the system log.	The Journaling Flash File System v2 (JFFS2) file system used on the ePower is a highly reliable, fault-tolerant, self-correcting file system designed for performance on embedded systems. This message indicates a common warning that JFFS2 is using a new segment of Not-And (NAND) gate flash and must first initialize that segment. You can ignore this message, because it is used only for internal kernel-level debugging.

Issue	Suggested Solution
The message Erase at XXXX failed immediately, followed by JFFS2: marking eraseblock at XXXX as bad. appeared in the system log.	This message indicates that JFFS2 has detected a bad NAND block and corrected the problem. NAND flash commonly wears down over time. The ePower implements "wear leveling," which significantly reduces the chances of this occurring. However, if it does occur, the ePower automatically marks the block as bad (as indicated by the aforementioned error message), and re-maps that bad address to a good address. This not a major problem, and can safely be ignored if you only see a handful of error messages similar to this in the logs. However, if you begin to notice a large number of error messages (greater than 50), contact Cyber Switching's Technical Support at support@cyberswitching.com.
How do I fix an upgrade failure when the error message is ipkg_download: ERROR: Command failed with return value 1: 'wget ... '?	This failure is typically caused by a network connectivity issue. First, check the ePower's network settings and verify that the IP address, subnet mask, gateway, and DNS servers are properly listed. Second, check the ePower's proxy settings, and verify that they are correct for your network. Finally, on a computer in the same subnet as the ePower unit, attempt to visit the URL mentioned in the error message. For further help, please contact Cyber Switching's Technical Support at support@cyberswitching.com.

Issue	Suggested Solution
I occasionally see the message TX underrun, resetting buffers in the ePower's data logs. Is this an issue?	This is a common house-cleaning message sent by the kernel, when the network transmit buffers are flushed. It can be safely ignored, and is a common Linux notification for embedded systems. This diagnostic output, and other, similar messages, are enabled to help Cyber Switching's Technical Support in the event of a support question.
On my ePower unit, why does the alert settings icon column appear to flicker?	The rendering engine in some browsers, notably Internet Explorer, can sometimes inappropriately redraw screen content in the middle of a data update. Once the data update is finished, the engine then redraws the screen, causing the flicker phenomenon. This behavior is harmless and can be ignored. If desired, try a different browser, such as Mozilla Firefox, for a more seamless experience.

Restoring Factory Default Settings

To reset the ePower to factory defaults:

1. Connect an RS-232D serial cable to the ePower unit's RS-232 serial port, and open a terminal emulation program, as described in the Initially Configuring the RS-232 Serial Port to Use the CLI section in Chapter 2, "Installing the ePower PDU."

2. Using a firm, thin object (such as the end of an unfolded paper clip), press and hold the reset button for 1 to 2 seconds.

3. When the bootloader appears, press any key to interrupt the bootloader. If successful, the U-boot> prompt will appear.

   If this prompt does not appear, repeat steps 2 and 3.

4. At the U-boot> prompt, enter cfg_rst, then press Enter.

   The unit starts booting as normal. During boot-up, the system re-creates the appropriate databases and files.

⚠ **CAUTION**   This step cannot be canceled after it starts. All the ePower unit settings will be lost and reverted back to the factory defaults, including outlet properties and user accounts. Perform this operation only if absolutely necessary.

✔ **NOTE**   Due to recreating the various databases, the system may take a few extra minutes to boot.

Troubleshooting a Tripped Outlet (Virtual Circuit Breaker)

After a Virtual Circuit Breaker is properly configured, any "trip" conditions should be properly investigated before resetting the circuit breaker's state. Constantly toggling the relay state from **Tripped** to **Off** to **On** without first clearing the condition that caused the trip causes the relay to trip again. If the trip occurs at a high amperage, this can reduce the lifetime of the relay.

⚠ **CAUTION**   A qualified electrician should be called to investigate and resolve tripped breakers. Failure to resolve the root cause of tripped breakers can cause severe damage to equipment and other facilities.

To troubleshoot a tripped outlet (Virtual Circuit Breaker):

1. Identify the equipment plugged into the tripped outlet.

2. Are there any obvious problems with the equipment? Is the cord frayed? Is there a burnt smell? Correct these issues with the equipment.

3. Unplug the equipment and reset the Virtual Circuit Breaker.

4. If the Virtual Circuit Breaker resets okay, have the equipment checked out by a qualified service technician. If the technician cannot identify any issues with the equipment, contact Cyber Switching Technical Support for additional assistance.

Resetting the ePower PDU

Resetting the ePower PDU performs a hardware reset of the internal Network Interface Card (NIC) in the event of a lock-up. The reset button is located beside the RS-232 serial port, through the access hole (refer to Figure 7-1).

Figure 7-1   Reset Button Location
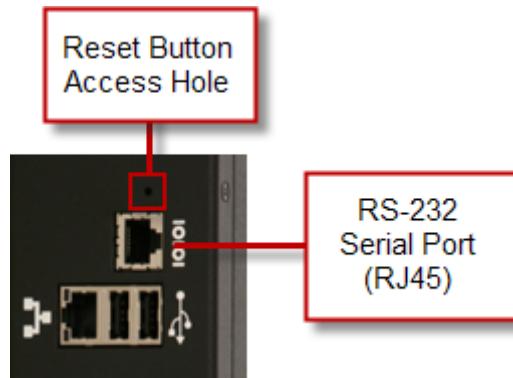
To reset the ePower PDU:

1. Using a firm, thin object (such as the end of an unfolded paper clip), press and hold the reset button for 1 to 2 seconds.

    The LCD touch screen goes blank and darkens. This indicates that the NIC is being held in hardware reset. No outlet states are affected at this time; however, RS-232 and network communication are terminated.

2. Release the reset button.

    The NIC begins its boot-up procedure. The first screen that opens is the "booting" screen referenced in the Configuring the Initial ePower Communication section in Chapter 2, "Installing the ePower PDU." The system boots up as described that section.

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A   CLI Command Reference

Syntax

The ePower command-line interface (CLI) conforms to the Server
Management Command Line Protocol 6 (SM CLP) Specification
(DSP0214 v1.0.2).

Commands are composed from the following four items:

- Verb
- Option
- Target
- Properties

Verb

Verbs are actions that are performed on a specified target or property. A verb can allow one or more options that modify the way the verb acts. The supported verbs, which are described in detail in this appendix, are:

- cd – Changes the current default target
- commit – Sets and/or updates a section of properties within a managed element
- exit – Terminates the ePower CLI process
- help – Displays information regarding how to use the ePower CLI
- reset – Restarts the ePower unit from boot-up
- set – Sets the value of properties within a managed element
- show – Displays the contents of a target
- version – Displays current version information for the ePower firmware

Example 1: The verb in this sample command is "show".

ePower:/‑‑> show -d properties -l all /system1/settings address==10.0.3.120

Option

Options are flags that change the way the verb acts. Verbs can allow one or more options on the command line. All options start with a leading dash "-" and can have one or more parameters following the option. Options and their parameters are separated by spaces.

Example 1: The options in this sample command are "-d properties" and "-l all".

ePower:/‑‑> show -d properties -l all /system1/settings address==10.0.3.120

Target

A target specifies the managed element on which the verb operates (refer to the ePower CLI Managed Elements Hierarchy section, for the managed elements structure). Managed elements use a tree structure for the grouping of elements within branches. All elements are under "/", or the root node.

To reach a given element, specify it using one of the following methods:

- Absolute path from the root
- Relative path from the current working target

The special symbols shown in Table A-1, used in standard UNIX file path notation, can be used to specify path elements.

Table A-1   Path Element Notation

Symbol	Verbal Description	Description
.	dot	Current working target
..	dot-dot	Parent element of working target
/	slash	Root element

Example 1:   If the current element is /dir1/dir2, the following target entries all access the same target.

- **ePower:/dir1/dir2–>** xyz
- **ePower:/dir1/dir2–>** ./xyz
- **ePower:/dir1/dir2–>** /dir1/dir2/xyz

Example 2:   The following target entries access the element dir1.

- **ePower:/dir1/dir2–>** ..
- **ePower:/dir1/dir2–>** ./..
- **ePower:/dir1/dir2–>** /dir1

Example 3:   The target in this sample command is "/system1/settings".

ePower:/–> show -d properties -l all /system1/settings address==10.0.3.120

Properties

Properties specify terms to use as filters. Results are returned only if they contain the specified property names. Do not use spaces within properties, such as between an equal sign and a value.

Example 1:   Set the working directory only within MyDomain.

ePower:/--> set /system1/settings/network domain=MyDomain

Example 2:   The property in this sample command is "address==10.0.3.120".

ePower:/--> show -d properties -l all /system1/settings address==10.0.3.120

Verb Descriptions

The supported ePower verbs are:

- cd
- commit
- exit
- help
- reset
- set
- show
- version

Each verb, as well as its syntax, description, response, and properties (as applicable) is discussed in the sections that follow.

cd

Syntax

cd [*target*]

Description

Changes the current default target. By default, the current default target is /.

To change the target, issue the "cd *target*" command. *target* must be an element that is "adjacent" to the Current Target Element in the nested hierarchy shown in the ePower CLI Managed Elements Hierarchy section. For example, assuming the current default target is /, the command "cd sytem1" is allowed, because the system1 element is a child element of / in the hierarchy. The command "cd network" is not allowed, because the network element is not a direct child element of / in the hierarchy.

If cd is issued without an explicit target, it uses the current default target, which means that the current default target remains unchanged. cd can be used to move relatively within the hierarchy. Issuing the "cd .." command sets the Current Target Element to the parent. Moving multiple levels is allowed by using the / character. For example, "cd ../.." moves the Current Target Element to the parent of the parent of the Current Target Element. This works the same way as cd in a Linux environment. If a target that does not exist is specified, an error is generated and the Current Target Element remains as is.

Response

The ePower CLI prompt changes to reflect the Current Target Element.

✔ **NOTE** In the following examples, note the changing text within the ePower:/ CLI prompt, as the target changes.

Example 1: Change the Current Target Element, using relative paths.

ePower:/–> cd system1/settings/interfaces

ePower:/system1/settings/interfaces–>

Example 2: Change the Current Target Element from /system1/settings/interfaces to http.

ePower:/system1/settings/interfaces–> cd http
ePower:/system1/settings/interfaces/http–>

Example 3: Use cd, without specifying an explicit target.

ePower:/system1/settings/interfaces/http–> cd
ePower:/system1/settings/interfaces/http–>

Example 4: Change the Current Target Element, using UNIX file path notation.

ePower:/system1/settings/interfaces/http–> cd .
ePower:/system1/settings/interfaces/http–>

ePower:/system1/settings/interfaces/http–> cd ..
ePower:/system1/settings/interfaces–>

ePower:/system1/settings/interfaces–> cd ../..
ePower:/system1–>

Example 5: Specify a target above the root level. When specifying a target above the root level using UNIX file path notation (refer to Table A-1), the additional levels are ignored, and the resulting target is the root level.

ePower:/system1–> cd ../../../../
ePower:/–>

Example 6: Specify a target that does not exist.

ePower:/system1/settings–> cd TCPIP
SYNTAX ERROR: UNKNOWN TARGET: "TCPIP"
ePower:/system1/settings–>

Example 7: Change the Current Target Element, using an absolute path.

ePower:/–> cd /system1/settings/network/ipv6
ePower:/system1/settings/network/ipv6–>

commit

Syntax

commit [*target*]

Description

Sets and updates a section of properties within a managed element, specifically for network settings where all values need to be updated with a single command; otherwise unexpected behavior might occur.

The elements that support commit are /system1/settings/network and /system1/settings/interfaces/energywise.

Response

There is no response for the commit command.

Example 1: Set and update a section of properties within a managed element.

ePower:/–> commit /system1/settings/network

exit

Syntax

exit

Description

Terminates the ePower CLI process. The supported synonyms are:

- Ctrl-C (Break)

- Ctrl-D (End-of-File)

Example 1:   Terminate the current CLI session.

ePower:/–> exit

...[session disconnected]...

Response

The ePower login message is displayed.

help

Syntax

help [*options*] [*target*] [*properties*]

Description

Displays information regarding how to use the ePower CLI. If help is issued with no options, then a summary of this section is displayed.

Options

- –cd – Provides help for the cd command.
- –commit – Provides help for the commit command.
- –exit – Provides help for the exit command.
- –reset – Provides help for the reset command.
- –set – Provides help for the set command.
- –show – Provides help for the show command.
- –version – Provides help for the version command.

Properties

The help command recognizes a comma-separated list of properties and provides information regarding the specified properties for the given target. If no list of properties is given, then help provides information regarding all the properties in the target.

Response

Paragraph-formatted text from the CLI specification. help with no options returns a summary.

Example 1: Display help for the show command.

ePower:/–> help –show

show [<*options*>] [<*target*>] [<*properties*>][*propertyname==propertyvalue*]

-d, -display <*arg_values*>

Display the parts of the element, where parts are (targets, properties, verbs, all). The default value is all.

[Remainder of response not shown.]

Example 2: Display help for the IPv4 target.

ePower:/–> help /system1/settings/network/ipv4

ipv4 is a managed element and supports the following verbs:

     cd set show version help

Properties:

     address   : dotted decimal format: e.g. 10.0.3.2

     dhcp   : y/n to enable/disable dhcp.

     enable   : This is used to enable or disable the element as a feature this accepts text inputs (Y YES N NO TRUE FALSE YES NO)

     gateway   : dotted decimal format: e.g. 10.0.3.1

     mask   : dotted decimal format: e.g. 255.255.255.0

reset

Syntax

reset

reload

reboot

Description

Restarts the device, from boot-up; performs a warm-boot. This has almost the same behavior as toggling the power, except the outlets are unaffected during this process. This command is valid only at the system element.

⚠️ **CAUTION**   Use this command with caution, because it is a system reset.

Response

There is no command response for the reset command.

set

Syntax

set [*target*] *propertyname=value*

Description

Sets the value of properties in a managed element. If no target is specified, the current working target is used.

Properties

- propertyname=*value*

  Sets the property for the given target. Accepts a line with multiple property names and values, separated by spaces. For Boolean properties, accepts Y, Yes, True, or On, and N, No, False, or Off, but displays Y and N.

Response

There is no response for the set command.

Commands that contain invalid values for a given property return an ERROR status.

Example 1: Enable HTTP in the TCPIP element.

ePower:/system1/settings/network–> set ipv4 enable=Y
ePower:/system1/settings/network–>

Example 2: Set multiple properties on a single command line.

ePower:/system1/settings/network–> set ipv4 address=192.168.1.10 dhcp=N enable=y
ePower:/system1/settings/network–>

Example 3: Set an incorrect value for a property.

ePower:/system1/settings/network–> set ipv4 address=1234.5678.9101.1234
COMMAND ERROR: INVALID PROPERTY VALUE: "1234.5678.9101.1234"
ePower:/system1/settings/network–>

show

Syntax

show [*options*] [*target*] [*properties*] [*propertyname==propertyvalue*]

Description

Displays the contents of a target. If no target is specified, the current default target is used.

Options

- -d, -display *properties*

  Displays output that matches the indicated property type(s) (*targets*, *properties*, *verbs*, all), where all is the default if omitted.

- -l, -level *value*

  Restricts the output to *value* levels deep in the hierarchy. The keyword all can be used for *value*. Default is 1.

- -a, -all

  Returns all data element types subject to any filtering of categories by the display and level options.

Properties

- *properties*

  A comma-separated list of property names to use as a filter. If show is displaying properties, that is, "show –d *properties*", then return only results that contain the specified property names.

- *propertyname==value*

  A property name and associated value to use as a filter. If show is displaying properties, that is, "show –d *properties*", then only return results that contain the specified name and corresponding value. This CLI only supports a single equality filter and does not support a comma-separated list of equality filters.

Response

If show is issued with no options, all elements (*targets*, *properties*, and *verbs*) for the specified target are displayed. The output format is as follows:

```
[Fully Qualified Target Address]
Targets:
[Target 1]
[Target 2]
     [...]
[Target L]
Properties:
[Property 1] = [Value 1]
[Property 2] = [Value 2]
[Property 3][0] = [value 3.0] ** when property is a list
[Property 3][1] = [value 3.1]
     [...]
[Property M] = [Value M]
Commands:
[Command 1]
     [...]
[Command N]
```

L is the number of targets within the target, *M* is the number of properties within the target, and *N* is the number of verbs in the target.

If any of the sections do not have any output details to display, the literal string [None] is displayed in that section.

Example 1:   Show all elements in the current default target.

ePower:/–> show

/

Targets:

      session

      system1

Properties:

      [None]

Commands:

      cd

      show

      help

ePower:/–>

When show is used with options other than all, such as –d properties, the output format is the same as above, with the other elements omitted.

Example 2:   Show the properties in the IPv4 target.

ePower:/–> show -d properties /system1/settings/network/ipv4

/system1/settings/network/ipv4

Properties:

      address = 10.0.3.120

      dhcp = N

      enable = Y

      gateway = 10.0.3.1

      mask = 255.255.255.0

Example 3:   Recursively show the available commands for the network target.

ePower:/--> show –l all -display verbs system1/settings/network

/system1/settings/network

Verbs:

    cd

    show

    set

    help

/system1/settings/network/ipv4

Verbs:

    cd

    show

    set

    help

/system1/settings/network/ipv6

Verbs:

    cd

    show

    set

    help

ePower:/-->

Example 4:   Show only properties with the name "address".

ePower:/--> show –d properties –l all /system1/settings/network address

ePower:/system1/settings/network/ipv4

Properties:

    address = 10.0.2.102

ePower:/system1/settings/network/ipv6

Properties:

    address = ffe8:0123:4567::0427

ePower:/-->

version

Syntax

version

Description

Displays current version information for the ePower firmware.

Response

Returns the ePower firmware version information.

Example 1: Display the current firmware version (where YYYY is the year of release and RR is the number of the release (01, 02, 03, and so forth) within that year).

ePower:/–> version

Software Version:

csLinux YYYY.RR

ePower CLI Managed Elements Hierarchy

This appendix documents the ePower managed elements, which use a tree structure for the grouping of elements within branches. All elements are under "/" (the root node). To reach a given element, specify one of the following:

- Absolute path from the root

- Relative path from the current working target

Targets specify the managed element within the *ePower CLI Managed Elements Hierarchy* on which a verb operates. The following targets are supported:

```
|-- session/
`-- system1/
        |-- settings/
        |       |-- network/
        |       |       |-- ipv4
        |       |       `-- ipv6
        |       `-- interfaces/
        |               |-- energywise
        |               |-- http
        |               |-- https
        |               |-- rs232
        |               |-- ssh
        |               `-- telnet
        |
        `-- power/
                |-- inputX/        (Replace X with the input number)
                |       `-- meterP  (Replace P with the meter number:
                |                       - "1" for single phase units,
                |                       - "1" through "3" for three phase units)
                |-- /bankY/        (Replace Y with the bank number)
                |       |-- meter
                |       `-- alerts/
                |               `-- high_current
                |
```

```
           `-- outletZ/                    (Replace Z with the outlet number)
               |-- meter
               |-- alerts/
               |      |-- high_current
               |      |-- low_current
               |      `-- virtual_circuit_breaker
               `-- schedule
```

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B LCD Network Configuration Screens

At first boot, you can configure either or both the IPv4 and IPv6 communication settings, as shown in Figure B-1. After first boot, you must configure IPv4 (refer to Figure B-2) separately from IPv6 (refer to Figure B-3). Refer to Chapter 5, "Using the LCD Touch Screen," for information about appropriate entries for each screen.

Figure B-1   LCD Touch Screen Flow – First Boot, IPv4 and IPv6 Settings

ePower Power Distribution Unit User Manual, Revision 1.1
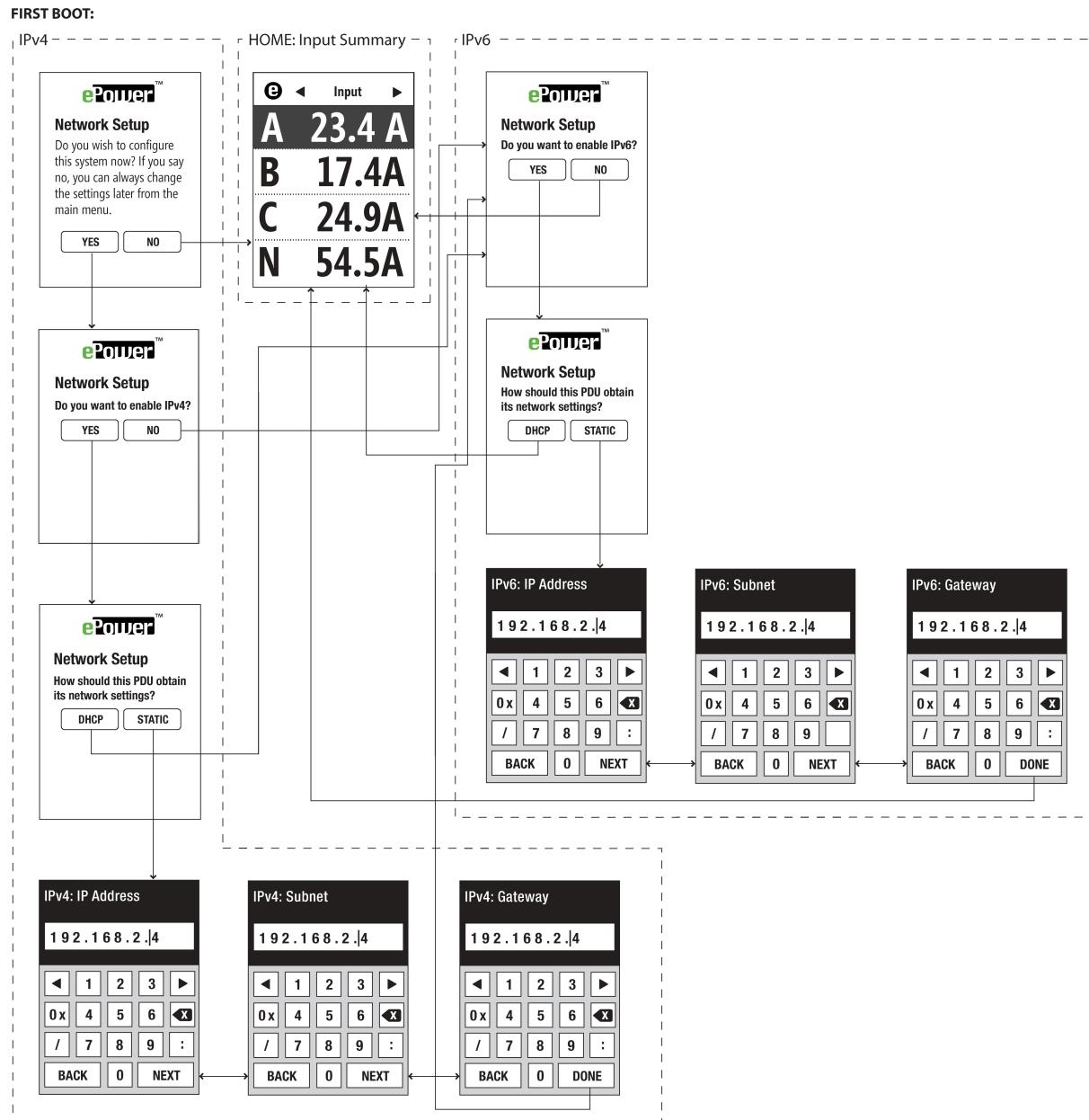
Figure B-2   LCD Touch Screen Flow – IPv4 Settings, after First Boot

REGULAR OPERATION:

Settings

IPv4

IPv4

Status:	**Connected**
MAC:	**00:23:32:d5:e7:b8**
Method:	**STATIC**
IP address	**192.168.2.4**
Subnet Mask:	**255.255.255.0**
Gateway:	**192.168.2.254**

RECONFIGURE

IPv4

Status: Connected

⚠ **WARNING**

Are you sure you want to
reconfigure your network
settings? You will lose
your previous settings.

YES   CANCEL

RECONFIGURE

◄ IPv4 Setup ►

Do you want to enable IPv4?

YES   NO

◄ IPv4 Setup ►

How should this PDU obtain
its network settings?

DHCP   STATIC

IPv4: IP Address

1 9 2 . 1 6 8 . 2 . 4

◄	1	2	3	►
0 x	4	5	6	◄X
/	7	8	9	:
BACK	0	NEXT		

IPv4: Subnet

1 9 2 . 1 6 8 . 2 . 4

◄	1	2	3	►
0 x	4	5	6	◄X
/	7	8	9	:
BACK	0	NEXT		

IPv4: Gateway

1 9 2 . 1 6 8 . 2 . 4

◄	1	2	3	►
0 x	4	5	6	◄X
/	7	8	9	:
BACK	0	DONE		

Figure B-3   LCD Touch Screen Flow – IPv6 Settings, after First Boot

REGULAR OPERATION:
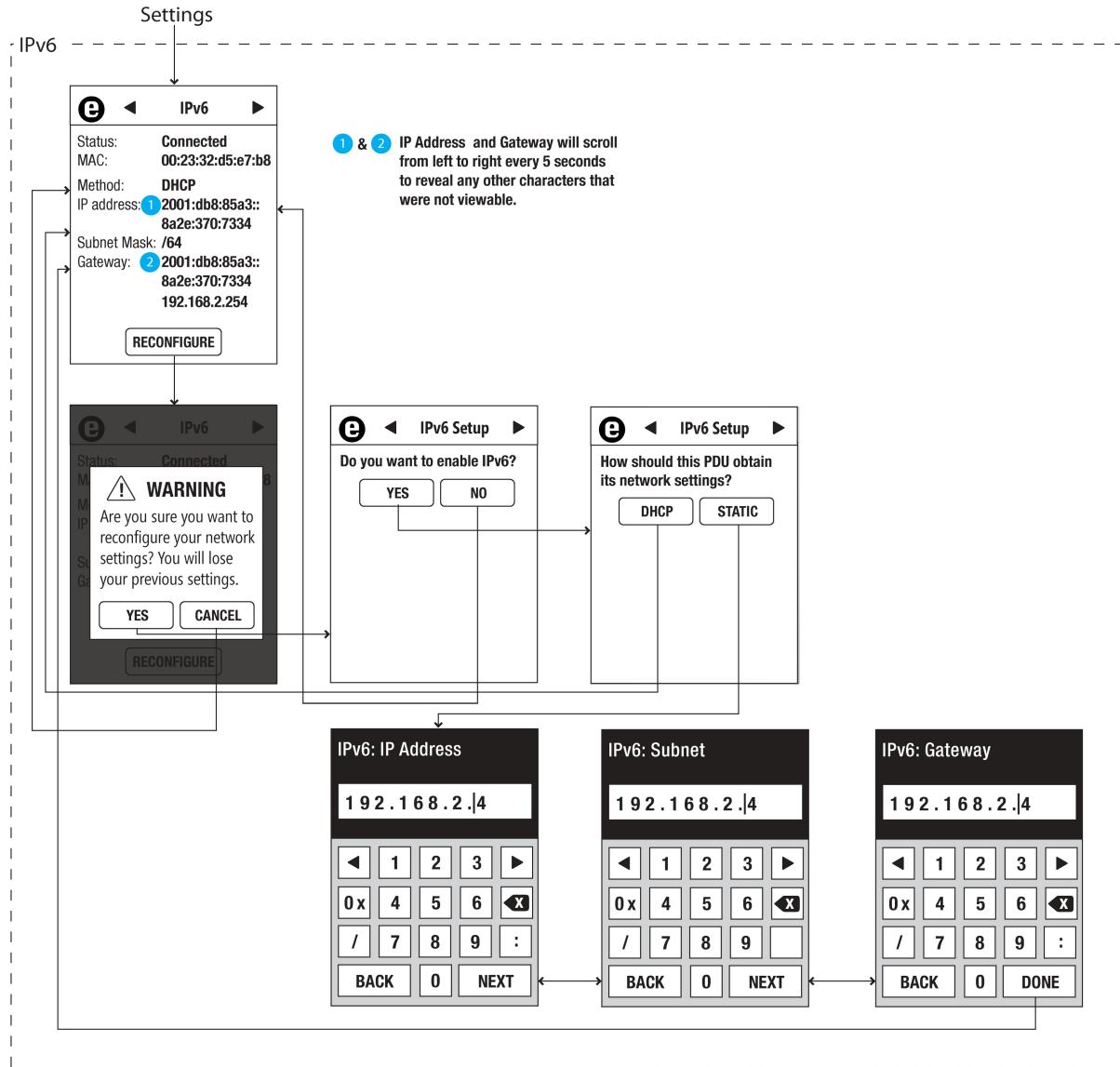
C   Cisco EnergyWise

Overview

In summary of *Cisco EnergyWise: Summary and Concepts (*white paper, C11-568212.pdf), Cisco® EnergyWise creates a platform for managing the energy usage of routers, switches, servers, and other datacenter-related equipment using standard IOS-based mechanisms. Cisco EnergyWise can be used to enforce enterprise-wide power management policies, gather power metrics into user-friendly dashboards, and enable customers to gain control over their power usage in both the datacenter and building infrastructure.

You can use the Cisco EnergyWise domain to manage equipment, such as routers, switches, servers, and other datacenter-related equipment. In a domain, a minimal deployment consists of at least three types of devices:

- **Endpoint**

  An endpoint is a device that consumes or meters power, such as an ePower PDU, that manages multiple loads, or an individual Power-Over-Ethernet (PoE) device.

- **Domain member**

  Domain members form the core of the Cisco EnergyWise domain, and pass messages ("queries") across the network. Typically, these are routers, switches, or other core infrastructure equipment.

- **Managers**

  Widely varied, managers can include the dashboards, query agents, and other applications that provide a user interface into the Cisco EnergyWise domain. One example of such a manager is the Cisco Orchestrator, a dashboard application for Cisco EnergyWise.

Additional information regarding Cisco EnergyWise can be found on the Cisco Web site, at www.cisco.com/go/energywise.

Integration with ePower

From the perspective of the Cisco EnergyWise domain, the ePower unit is an endpoint that enables advanced power monitoring and control of the individual loads connected to the ePower power outlets.

To enable integration with a Cisco EnergyWise domain:

1. Connect the ePower's network port to an upstream domain member, such as a Cisco Catalyst® switch.

2. Enable Cisco EnergyWise endpoint support for the ePower unit (or other domain member).

✔ **NOTE**   **Bold** is used to represent Cisco EnergyWise-specific configuration commands and prompts. *Italic* is used to represent variables.

Switch>enable

Switch#configure terminal

Switch(config)# **energywise domain** *domainname* **security shared-secret 0** *domainpw*

Switch(config)# **energywise endpoint security shared-secret 0** *endpointpw*

3. Using a Web browser, log in as an administrator-level user to the ePower Web interface.

4. Select the **Setup** link from top-right navigation bar on the **Home** page.

5. Select the **Interfaces** tab from the **Setup** page.

Figure C-1   ePower Setup Page, Interfaces Tab, Cisco EnergyWise Section

6. Scroll down the page to the section for Cisco EnergyWise (refer to Figure C-1), then configure the agent.

    a. Ensure that **Enable Agent** is selected.

    b. Enter the domain and endpoint password configured on the Cisco EnergyWise domain, represented by *domainname* and *endpointpw* in the example above. If you choose to enable *energywise endpoint security none* on the upstream Cisco EnergyWise domain member, leave the **Secret** field on the ePower agent blank.

    c. Enter the name of the ePower endpoint. If the **Name** field is left blank, the name of the endpoint in the Cisco EnergyWise domain is the fully qualified domain name (FQDN) of the ePower unit.

    d. Enter the role of the ePower endpoint. This required field is a textual description of the ePower unit's role in the Cisco EnergyWise domain, and is used only for management purposes. The default value is generically Power Distribution.

    e. Enter the keywords to use when filtering queries sent to the ePower endpoint. This optional field is a comma-separated list of "tags" that are sent with a Cisco EnergyWise query message, and used by the endpoints for response filtering.

    f. Select the ranking from the **Importance** drop-down list.

    On a scale of 1 to 100, this compares the relative importance of this ePower unit versus other EnergyWise endpoints in the Cisco EnergyWise domain. This ranking is typically used as a filter for policy-based network management. By convention, a lower value (1) is less important than a higher value (100).

7. Select **Save** when finished.

The ePower endpoint agent starts and attempts communication with the Cisco EnergyWise domain member. You can use the IOS commands show energywise children and energywise query (shown in Figure C-2) on the domain member, to verify that communication is established.

ePower creates separate Cisco EnergyWise entities for itself and each of the outlets on the ePower PDU. For example, on a 24-outlet ePower PDU, there would be 25 entities listed in the Cisco EnergyWise domain. The PDU entity's properties are set by way of the configuration fields in the **Setup > Interfaces > Cisco EnergyWise** section, described above. The outlets' properties are individually set by way of the configuration fields available in each outlet's overlay popup (which can be found on the **Home** page, by clicking the outlet's caption).

✔ **NOTE**   These settings can also found from the Command Line Interface and Web Services as well.

The ePower PDU's entity reflects the "overhead" that is needed to run the PDU itself. This entity is in the CONSUMER category, indicating that it is actually using the energy being reported by way of Cisco EnergyWise, and is read-only in that it always uses a level of 10.

The ePower outlet entities are in the METER category with a class of ACTUAL due to ePower's billing-grade accuracy, and report the energy being consumed by the equipment connected to the outlets. These entities are read/write; setting the level to **0** results in the outlet being turned Off, and setting the level to a non-zero value (**1-10**) results in the outlet being turned On.

All Cisco EnergyWise attributes (name, keywords, importance, level, and so forth) for the PDU itself and each of the outlets are maintained separately.

Figure C-2   Querying ePower Data using Cisco EnergyWise
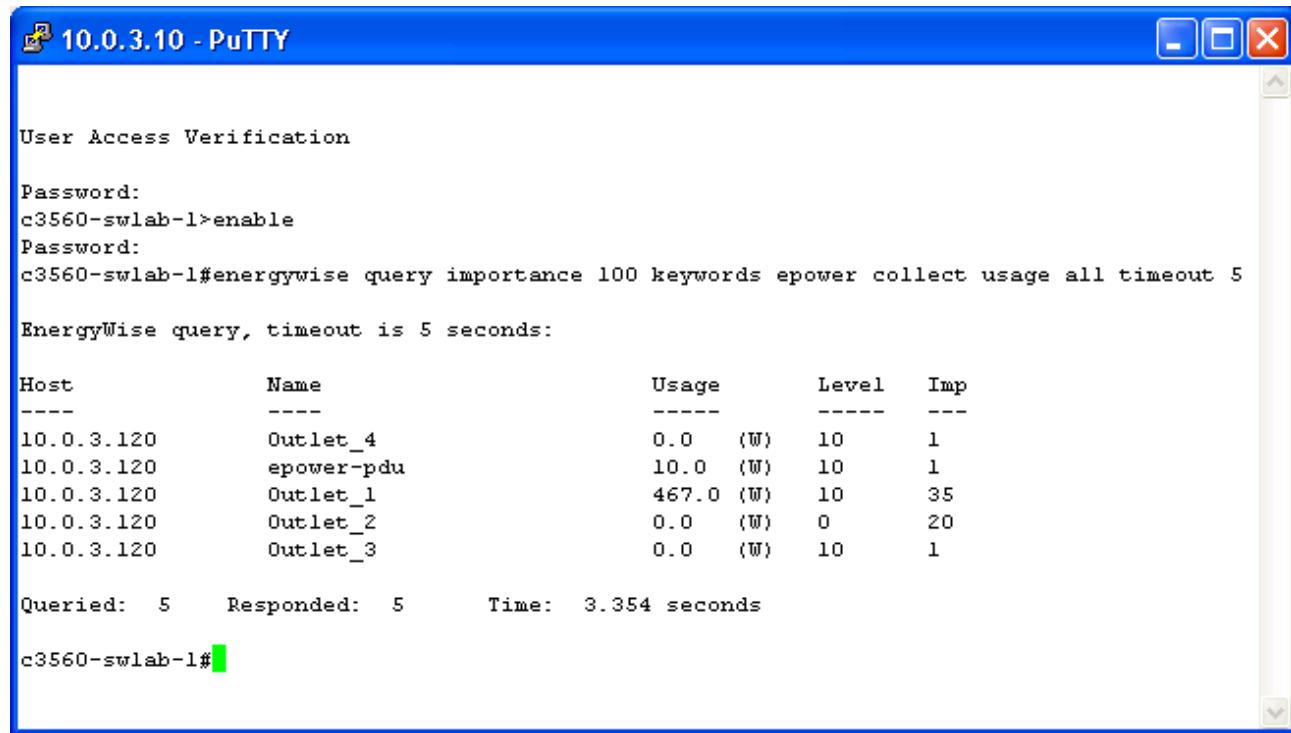

```
10.0.3.10 - PuTTY


User Access Verification

Password:
c3560-swlab-1>enable
Password:
c3560-swlab-1#energywise query importance 100 keywords epower collect usage all timeout 5

EnergyWise query, timeout is 5 seconds:

Host                Name                        Usage       Level   Imp
----                ----                        -----       -----   ---
10.0.3.120          Outlet_4                    0.0    (W)  10      1
10.0.3.120          epower-pdu                  10.0   (W)  10      1
10.0.3.120          Outlet_1                    467.0  (W)  10      35
10.0.3.120          Outlet_2                    0.0    (W)  0       20
10.0.3.120          Outlet_3                    0.0    (W)  10      1

Queried:  5    Responded:  5      Time:  3.354 seconds

c3560-swlab-1#
```

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All packages and modifications can be downloaded from:
epower.cyberswitching.com/sources/

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